



Delta RMP Technical Advisory Committee Meeting Friday, September 21, 2018 10:00 am – 4:00 pm

Sunset Maple Room, Regional San
10060 Goethe Road, Sacramento, CA

Remote Access:

Phone number: (415) 594-5500

Access Code: 238-626-034#

Online: <https://join.me/sfei-conf-cw2>

Agenda

#	Agenda Item and Desired Outcomes	Attachments	Start & Lead
1	Introductions and Agenda Review and agree on agenda and desired outcomes.		10:00 – 10:10 Stephen McCord Gita Kapahi
2	Decision: Approve TAC Meeting Summary for June 12, 2018 meeting and confirm future TAC meeting dates <u>Upcoming Scheduled Meetings:</u> <ul style="list-style-type: none"> Pesticides Subcommittee meeting with Deltares: Sept 25, 2018, 9am-noon Joint Meeting: Oct 29, 2018, 10am–5pm at Cal/EPA Pesticides Subcommittee: Friday, Nov 9, 2018 (with Deltares) Steering Committee: Feb 22, 2019 <u>Set dates for future meetings:</u> <ul style="list-style-type: none"> TAC: Dec 2018 or Jan 2019 Desired outcomes: <ul style="list-style-type: none"> Approve previous TAC meeting summaries Confirm future TAC meeting dates 	a) Draft Summary of June 12, 2018 TAC Meeting* b) Draft Summary of June 29, 2018 Teleconference*	10:10– 10:30 Stephen McCord
3	Information: Steering Committee Update TAC Chair will summarize outcomes of the July 17, 2018 SC meeting including relevant decisions and action items. Desired outcomes: <ul style="list-style-type: none"> Informed TAC 	Draft Summary of July 17, 2018 Steering Committee Meeting*	10:30 – 10:45 Stephen McCord Matt Heberger

4	<p>Technical Subcommittee and Monitoring Updates Brief updates on subcommittees and monitoring activities</p> <ul style="list-style-type: none"> • CEC planning update for current fiscal year (for monitoring next FY). • Update on Delta Nutrient Research Plan, Chlorophyll Intercalibration Study and Bay Nutrient Management Strategy. <p>Desired outcome:</p> <ul style="list-style-type: none"> • Review running table of past and upcoming sampling events. • Inform TAC of subcommittee activities and recommendations. 	Tables: (1) Past and planned sampling events, (2) Status of Delta RMP datasets	10:45 – 11:15 Matt Heberger Janis Cooke Stephen McCord
5	<p>Decision: Recommend approval of Pathogens Monitoring Final Report This study by Larry Walker Associates was designed to fulfill the dual purposes of characterizing ambient conditions for pathogens (Cryptosporidium and Giardia) throughout the (Delta) and to satisfy regulatory requirements.</p> <p>Desired outcome:</p> <ul style="list-style-type: none"> • Recommendation from the TAC to the SC to approve and publish the report. 	*Revised Final Draft Pathogens Report	11:15 – 11:30 Brian Laurenson Hope McCaslin Taylor
6	<p>Decision: Recommend final publication of FY16/17 Pesticides Data</p> <p>Desired outcome:</p> <ul style="list-style-type: none"> • Recommendation from the TAC to the SC to approve and publish the dataset. 	<p>Spreadsheet of FY16/17 Pesticides Chemistry Data*</p> <p>Memo from ASC QA Officer*</p> <p>Pesticides Dataviz*</p>	11:30 – 12:00
7	<p>Science advisors At our June 12 meeting, the TAC requested a schedule of Delta RMP activities and deliverables to help guide us on how and when to engage our volunteer science advisors.</p> <p>Desired outcome: Input into how to most effectively engage our volunteer science advisors.</p>	Memo: Revised Science Advisor Strategy	11:30 – 12:00 Matt Heberger
	Lunch		12:30 – 1:30

8	<p>Pesticides and Toxicity Monitoring Design</p> <p>The SC approved funding for proposed Water Year 2019 monitoring at its July meeting. Since then, ASC staff, the Pesticides Subcommittee and the Toxicity Workgroup have been working to finalize the details of the sampling and analysis plan.</p> <p>Desired outcomes:</p> <ul style="list-style-type: none"> • Inform TAC members about key monitoring design details. • TAC confirm/revise recommendations. • Inform TAC of QAPP approval process and monitoring implementation 	<p>Presentation: Pesticides Monitoring Design Update</p>	<p>1:30 – 2:30 Matt Heberger</p>
9	<p>Relevant grant proposals</p> <p>The SC requested that RMP members reach out to prospective Prop. 1 proposers to identify RMP roles (w/task & budget) in their proposals, in coordination with the Delta Science Program, Delta Conservancy, and CDFW (Prop. 1 administrator). Also get updates on recently submitted grant proposals.</p> <p>Desired outcomes:</p> <ul style="list-style-type: none"> • Identify potential Prop 1 proposers so that we can contact them and seek to coordinate. • Confirm desire for ASC to submit proposal on behalf of the Delta RMP to support CEC monitoring and/or expand pesticides and toxicity monitoring. 	<p>Link to Delta Science Proposal Solicitation: http://deltacouncil.ca.gov/delta-science-joint-proposal-solicitation</p>	<p>2:30 – 2:45 Stephen McCord</p>
10	<p>Planning for the October 29, 2018 Joint TAC-SC Meeting</p> <p>Every fall, the joint meeting is a chance to assess the program's goals and priorities and engage in long-range planning.</p> <p>Desired outcomes:</p> <ul style="list-style-type: none"> • "Plus/Delta" style suggestions on the agenda • Suggestions for what to cover 	<p>Draft Agenda Outline for the Fall Joint Meeting</p>	<p>2:45 – 3:30 Matt Heberger</p>
11	<p>Information: Status of Deliverables and Action Items</p>	<p>Delta RMP Stoplight Reports</p>	<p>3:30 – 3:45 Matt Heberger</p>
12	<p>Wrap Up</p> <ul style="list-style-type: none"> • Review Action Items • Plan future agenda items 		<p>3:45 – 4:00 Gita Kapahi</p>
	<p>Adjourn</p>		<p>4:00</p>

*Draft meeting summaries and draft reports are distributed only to Delta RMP committee members until approved and made public.

Meeting Materials for Item 4

Past & Planned Monitoring Events				
Table last updated	9/13/2018			
Fiscal Year	Date	Monitoring Element	Frequency	Comments
FY16/17	Aug 22-23, 2016	Mercury (water) - quarterly	Quarterly	
FY16/17	Aug 22-23, 2016	Mercury (fish) - annual	Annually	
FY16/17	Sept 13, 2016	Mercury (fish) - annual	Annually	
FY16/17	Nov 14-15, 2016	Mercury (water) - quarterly	Quarterly	
FY16/17	Feb 28, 2017	Mercury (water) - quarterly	Quarterly	
FY16/17	April 25, 2017	Mercury (water) - quarterly	Quarterly	
FY17/18	Aug 14-18, 2017	Mercury (fish) - annual	Annually	
FY17/18	Oct 18-19, 2017	Mercury (water and sediment)	Water: 8x per year, Sediment: quarterly	
FY17/18	Jan 29-30 2018	Mercury (water and sediment)	Water: 8x per year, Sediment: quarterly	
FY17/18	Feb 26-27 2018	Mercury (water)	Water: 8x per year, Sediment: quarterly	
FY17/18	Mar 19-20 2018	Mercury (water)	Water: 8x per year, Sediment: quarterly	
FY17/18	Apr 16-18 2018	Mercury (water and sediment)	Water: 8x per year, Sediment: quarterly	
FY17/18	May 15-16 2018	Mercury (water)	Water: 8x per year, Sediment: quarterly	
FY17/18	Jun 11-12 2018	Mercury (water and sediment)	Water: 8x per year, Sediment: quarterly	
FY18/19	Jul 9-10 2018	Mercury (water)	8x per year	
FY18/19	Aug 13-14 2018	Mercury (water)	8x per year	
FY18/19	Aug 20-22 2018	Mercury (fish) - annual	Annually	
FY18/19	Sept 10-12 2018	Mercury (water and fish)	Water: 8x per year, Fish: annually	
Future monitoring events to be planned by ASC and MLML staff in collaboration with Mercury Subcommittee				
Pesticides				
Fiscal Year	Date	Monitoring Element	Frequency	Comments
FY15/16	Jul 28, 2015	Pesticides	Monthly	
FY15/16	Aug 18, 2015	Pesticides	Monthly	
FY15/16	Sep 23, 2015	Pesticides	Monthly	
FY15/16	Oct 21, 2015	Pesticides	Monthly	
FY15/16	Nov 10, 2015	Pesticides	Monthly	
FY15/16	Dec 15, 2015	Pesticides	Monthly	
FY15/16	Jan 19, 2016	Pesticides	Monthly	
FY15/16	Feb 17, 2016	Pesticides	Monthly	
FY15/16	Mar 7, 2016	Pesticides	Monthly	
FY15/16	Apr 19, 2016	Pesticides	Monthly	
FY15/16	May 18, 2016	Pesticides	Monthly	
FY15/16	Jun 15, 2016	Pesticides	Monthly	
FY16/17	Jul 13, 2016	Pesticides	Monthly	

FY16/17	Aug 17, 2016	Pesticides	Monthly		
FY16/17	Sep 20, 2016	Pesticides	Monthly		
FY16/17	Oct 18, 2016	Pesticides	Monthly	Default sampling date	
FY16/17	Nov 14, 2016	Pesticides	Monthly	Default sampling date	
FY16/17	Dec 16, 2016	Pesticides	Monthly	Deviated from default sampling date to capture major runoff event	
FY16/17	Jan 9, 2017	Pesticides	Monthly	Deviated from default sampling date to capture major runoff event	
FY16/17	Feb 28, 2017	Pesticides	Monthly	Deviated from default sampling date because some of the sites were inaccessible	
FY16/17	Mar 14, 2017	Pesticides	Monthly	Default sampling date	
FY16/17	Apr 25, 2017	Pesticides	Monthly	Default sampling date	
FY16/17	May 16, 2017	Pesticides	Monthly	Default sampling date	
FY16/17	Jun 13, 2017	Pesticides	Monthly	Default sampling date	
WY19	October 2019	Pesticides	6 events	Planning 6 sampling events. First event to coincide with first major fall/winter storm.	
Timing of sampling events described in QAPP. Specific dates to be selected based on weather and tide forecasts by staff of the USGS Pesticide Fate Research Group (PFRG).					
Pathogens					
Fiscal Year	Date	Monitoring Element	Frequency	Comments	
FY14/15	April 6-8, 2015	Pathogens	Monthly	Default sampling date	
FY14/15	May 4-6, 2015	Pathogens	Monthly	Default sampling date	
FY14/15	June 1-3, 2015	Pathogens	Monthly	Default sampling date	
FY15/16	July 6-7, 2015	Pathogens	Monthly	Default sampling date	
FY15/16	Aug 3-5, 2015	Pathogens	Monthly	Default sampling date	
FY15/16	Sept 7-9, 2015	Pathogens	Monthly	Default sampling date	
FY15/16	Oct 5-7, 2015	Pathogens	Monthly	Default sampling date	
FY15/16	Nov 2-4, 2015	Pathogens	Monthly	Default sampling date	
FY15/16	Dec 7-9, 2015	Pathogens	Monthly	Default sampling date	
FY15/16	Jan 4-6, 2016	Pathogens	Monthly	Default sampling date	
FY15/16	Feb 7-9, 2016	Pathogens	Monthly	Default sampling date	
FY15/16	March 7-10, 2016	Pathogens	Monthly	Default sampling date	
FY15/16	April 4-7, 2016	Pathogens	Monthly	Default sampling date	
FY15/16	May 2-5, 2016	Pathogens	Monthly	Default sampling date	
FY15/16	June 6-8, 2016	Pathogens	Monthly	Default sampling date	
FY16/17	July 5-7, 2016	Pathogens	Monthly	Default sampling date	
FY16/17	Aug 1-3, 2016	Pathogens	Monthly	Default sampling date	
FY16/17	Sept 6-8, 2016	Pathogens	Monthly	Default sampling date	
FY16/17	Oct 3-5, 2016	Pathogens	Monthly	Default sampling date	
FY16/17	Nov 7-9, 2016	Pathogens	Monthly	Default sampling date	
FY16/17	Dec 5-7, 2016	Pathogens	Monthly	Default sampling date	
FY16/17	Jan 9-11, 2017	Pathogens	Monthly	Default sampling date	
FY16/17	Feb 6-8, 2017	Pathogens	Monthly	Default sampling date	

FY16/17	March 6-8, 2017	Pathogens	Monthly	Default sampling date	
No further pathogens monitoring planned by the Delta RMP.					
Fiscal Year	Date	Monitoring Element		Comments	
FY17/18	Sept 19-21, 2017	Nutrients High-Frequency Cruise (3 consecutive days)		First of 3 planned sets of 3-day cruises. One of the instruments did not work properly, so Days 2 & 3 were cancelled. Monitoring will continue in the spring and summer of 2018.	
FY17/18	May 15-17, 2018	Nutrients High-Frequency Cruise (3 consecutive days)		Repeat of first cruise which was cancelled due to equipment failure.	
planned and funded in FY17/18	July 24, 25, 26, 2018	Nutrients High-Frequency Cruise (3 consecutive days)		Second cruise (done)	
planned and funded in FY17/18	Oct 16, 17, 18, 2018	Nutrients High-Frequency Cruise (3 consecutive days)		Third cruise (planned)	

Status of Delta RMP Datasets	
Table last updated:	9/14/2018
Parameter group	Status
Pesticides	
FY15/16 Current Use Pesticides	Published and publicly available via CD3 and CEDEN
FY 16/17 July - Sept 2016 Current Use Pesticides	Published and publicly available via CD3 and CEDEN
FY16/17 Oct 2016 - June 2017 Current Use Pesticides	QA finished; problems resolved. Uploaded to CEDEN but not available to public. Release pending TAC review and SC approval.
FY 16/17 field measurements (temperature, pH, DO, etc.) for Current Use Pesticides	Final but not yet published; waiting for TAC review and SC approval.
Toxicity	
FY15/16 Aquatic Toxicity Results	Published and publicly available via CD3 and CEDEN
FY16/17 Aquatic Toxicity Results	Published and publicly available via CD3 and CEDEN
Mercury	
FY16/17 Fish, Water, and Sediment	Final but not yet published -- Provisional data available to TAC and SC members.
FY17/18 Fish, Water, and Sediment	sampling underway, some data received from lab, nothing published yet.
Nutrients	
FY17/18 High-Frequency Monitoring	Sampling not done yet; USGS to handle all data management and QA of the high-frequency data (very large datasets). Data available upon request from PI Brian Bergamaschi, bbergama@usgs.gov.
Pathogens	
FY15/16 Pathogens	Published and publicly available via CD3 and CEDEN
FY16/17 Pathogens	Final but not yet published. Data to be released after TAC review and SC approval of the Pathogens Data Report.

Meeting Materials for Item 6



Date: July 11, 2018 (revised September 12, 2018)

From: Donald Yee, ASC QA Officer and Matthew Heberger, Delta RMP Program Manager

To: Delta RMP Technical Advisory Committee

Re: Review of 2016-2017 Current Use Pesticide QA/QC Data

General summary

This memo summarizes the quality assurance (QA) review of the Delta Regional Monitoring Program (Delta RMP) Fiscal Year 2016–2017 (FY16/17) data for laboratory analyses of pesticides, copper, and ancillary measurements in water. This review was conducted by ASC scientists and technical staff under the supervision of QA Officer Dr. Donald Yee.

All samples were collected and analyzed by scientists and technicians at the U.S. Geological Survey (USGS). Staff of the USGS Pesticide Fate Research Group (PFRG), Organic Chemistry Research Laboratory (OCRL) in Sacramento, CA conducted both the field sampling and lab analyses for pesticides and conventional water quality parameters, under the supervision of Chief Chemist (CC) James Orlando. Samples were analyzed for a suite of Current Use Pesticides (CUP) at OCRL in Sacramento. Sample water was divided and subsamples were shipped to the USGS National Water Quality Laboratory (NWQL) in Denver, CO for analysis of dissolved organic carbon (DOC), particulate organic carbon (POC), and copper. More information about how samples were collected and analyzed can be found in the program's 2016 pesticides data report.¹

There were 2 DOC field samples not reported. Aside from that, we found that 100% of the lab results for field samples were reportable (not rejected), although most of the pesticides were not detected in most samples.

Copper showed variable recoveries in matrix spikes, deviating more than the QAPP-specified average $\pm 25\%$ from target values, despite good recovery in lab control samples (a clean matrix).

¹ Jabusch, T., P. Trowbridge, M. Heberger, J. Orlando, M. De Parsia, and M. Stillway. "Delta Regional Monitoring Program Annual Monitoring Report for Fiscal Year 2015–16: Pesticides and Toxicity." Richmond, CA: San Francisco Estuary Institute – Aquatic Science Center, 2018.
<http://www.sfei.org/documents/delta-pesticides-2016>.

This suggests possible interferences with the copper analysis in natural matrix samples, so field sample results for copper were qualified.

At the end of this memo, Table 1 summarizes the results of the QA review.

Approach

About 20% of all reported records were for quality assurance and quality control purposes.

For this review, we, the project data management team (DMT) and project QA Officer (QAO), used the data electronically submitted by the laboratories and compiled it into a local database to first verify that the correct number of field samples and required number of QC samples are reported for the requested analyses.

We then compared the results for QC samples to the acceptance criteria, or measurement quality objectives (MQOs) listed in the program's Quality Assurance Program Plan (QAPP).² We did this by independently recalculating precision (as relative percent difference, RPD, or relative standard deviation, RSD) for lab replicates, and percent recovery for samples with known expected concentrations³. In order to verify that contamination of samples had not occurred in sampling or lab analysis, we compared the results for blank samples (both field and lab blanks) to method detection limits. In cases where an analyte is detected in a blank, we compared the measured concentration in the blank sample to concentrations measured in in field samples to determine the proportion of the signal that originates from lab contamination.

Where deviations from the project MQOs were found, we attached a flag or qualifier to the record. In some cases, records may have already been flagged by the reporting lab. Qualifiers added by ASC or the lab indicate that there has been a deviation from the project's quality criteria, and are meant to warn data users that certain records may be inaccurate or imprecise, or otherwise may need to be interpreted with caution. When the code is added by ASC rather than by the lab, it is preceded by a 'V'.

If data not meeting MQOs were not flagged by the laboratory, the DMT and QAO communicate with the laboratory to verify the reported data contain no transcription errors, missed

² Jabusch, Thomas, Don Yee, and Amy Franz. "Delta Regional Monitoring Program Quality Assurance Program Plan, Version 2.2." San Francisco Estuary Institute – Aquatic Science Center, September 30, 2016.

https://www.waterboards.ca.gov/centralvalley/water_issues/delta_water_quality/delta_regional_monitoring/wq_monitoring_plans/2016_0930_drmp_qapp.pdf.

³ Most labs calculate these metrics as a part of their internal QA, to identify lab performance outside of their usual controls. We request labs submit these metrics along with the data, however, we independently recalculate them to identify issues such as miscoded samples or transcription errors.

conversions or similar errors. If necessary, corrections are made to the data during this process. Otherwise, the data are flagged by the QAO (QA codes in the database that start with letter “V” are applied by QAO rather than the lab). Systematic problems with the analysis or reporting of data are discussed with the lab to identify appropriate corrective actions for either re-reporting the samples or for future analyses. In the most severe cases, data may be rejected and not reported. However, for this project, all data were reportable, as we did not find serious violations of the quality objectives that would lead to rejection of data.

A more detailed narrative of the review of QC data submitted by the labs is presented below.

USGS OCRL – Current Use Pesticides

The section below describes the QA of current use pesticide data analyzed at the USGS Organic Chemistry Research Laboratory (OCRL). See Table 1 at the end of this memo for a summary of the QA review.

General findings and recommended actions

All of the laboratory data were reportable (not rejected) for the target analytes.

There was initially low precision (RPD > 70%) for two pesticides, due to the mistaken reporting by the lab of field blanks as being field replicates. There were also results sporadically omitted from submissions requiring followup to determine the reasons for omission. Recoding and resubmission of the data fixed these errors, but created extra work, first in finding the seemingly low precision, then in reanalyzing the QC after the resubmission. *The lab should work on internal procedures to better ensure that the submitted data is both complete and matches what they have recorded internally.*

Completeness

All of the expected results were reported by the lab. Results were reported for 152 compounds in dissolved phase and 130 in particulate phase. The lab reported all expected results from regular field samples (for each analyte: n = 60, 12 monthly samples at 5 stations) plus field replicates (minimum 5% frequency or n = 3 samples for each analyte).

Blanks and matrix spikes/duplicates (MS/MSDs) were also reported at a minimum 5% frequency (3 or more of each). For MS/MSDs this is in accordance with the DRMP QAPP, but for blanks this may be less than 1 per 20 “or batch”. Batches without blanks were therefore flagged in BatchVerificationCode “VQI” for incomplete QC. All pesticides were non-detect in all blanks, so the impact of fewer blanks may not be severe.

Hold times

All of the samples were prepared/preserved within less than 24 hours, well within the 48 hour hold time limit. Samples were analyzed within the QAPP required 30 days after preparation so no results were flagged for hold time.

Sensitivity

About 80% of the target analytes were non-detect in all the dissolved or particulate samples. About 18% of pesticides were detected in less than half the samples, with only 2% of the analytes detected in half or more of the samples. This is expected, as most pesticides, if used properly, should only be found at low concentrations in the environment. Records in the database with results below their respective MDLs (reported in the same record) should not be regarded as fully quantitative as explained in the following paragraph.

The OCRL computes method detection limits (MDLs) for pesticide compounds it analyzes following standard analytical chemistry methods as outlined in two publications.⁴ Chemists at the OCRL follow best practice in reporting results when they can be reasonably certain the compound is present in the sample, even when the concentration of a chemical is below the calculated and published MDL. These results have a greater uncertainty, and data users are cautioned that the result should be considered an estimate. This communication is done via the database in two ways. First, the database field ResultQualCode is assigned the value “ND” for non-detect. Second, the field QACode is assigned the value JA (Analyte positively identified but quantitation is an estimate) or JDL (Estimated result lower than detection limit). In total, 86 results were reported but flagged because the result was lower than the MDL. These results accounted for less than 0.5% of the 18,754 chemistry results.

Blank contamination

Accurate measurement of analytes at low concentrations sometimes requires correcting for background sources of contamination, such as traces in reagents, solvents, glassware, or other sample processing hardware used in the analysis. Analyzing “method blanks” or “lab blanks” lets us demonstrate that these materials are free from contamination that would interfere with analysis of the sample. No pesticides were found in any of the lab blank or field blank samples. Therefore, no blank qualifiers were needed. All pesticides results are reported without blank correction.

Results less than three times the computed concentration in a blank have a high probability of not being quantitative, as the measured blank(s) can account for a third or possibly more of the

⁴ Hladik, Michelle, Kelly L. Smalling, and Kathryn Kuivila. “Methods of Analysis-Determination of Pyrethroid Insecticides in Water and Sediment Using Gas Chromatography/Mass Spectrometry.” Techniques and Methods 5 – C2. US Geological Survey, 2009. <https://pubs.usgs.gov/tm/tm5c2/tm5c2.pdf>.

Hladik, Michelle, and Daniel L. Calhoun. “Analysis of the Herbicide Diuron, Three Diuron Degradates, and Six Neonicotinoid Insecticides in Water-Method Details and Application to Two Georgia Streams.” Scientific Investigations Report 2012–5206. US Geological Survey, 2012. <https://pubs.usgs.gov/sir/2012/5206/pdf/sir20125206.pdf>.

total signal. Table 1 shows that no results were $<3\times$ the blank, so it is unlikely that a majority of the total signal in any sample is from blank contamination.

Precision

The precision of analysis methods (ability to consistently obtain the same result) is determined by analyzing replicate samples. The lab analyzed “laboratory replicates” (where the field sample is split in the laboratory and each subsample is analyzed separately) to assess the repeatability of measurements. Further, field crews collected “field replicates” (two or more samples collected in the same place at the same time) to demonstrate lack of contamination in the field. For most analytes, we would like replicate samples to be within 25% (RPD or RSD) of one another; the acceptance ranges are specified as the MQOs in the QAPP Table 4.3. However, most analytes were never detected in any sample, so we could not estimate precision for those in unspiked field samples.

Because of this, we evaluated precision primarily based on the results of matrix spike duplicates (MSDs), where two samples are each spiked with a known amount of a contaminant. In general, we found that there was a good agreement between these paired samples, with an average RPD of 15% or less for all analytes, well within the target 25%.

Azoxystrobin and boscalid initially had RPDs over 100%, due to samples with switched IDs. This was corrected on a later resubmission.

Table 1 reports the range of precision estimates for the various analyte groups. Rather than reporting the QA measurement for all 152 pesticide analytes, we have reported the average and the range for the compounds in the particulate phase, and in the dissolved phase measured with different instruments and methods (LC/MS vs. GC/MS). We estimated precision using the relative percent difference (RPD) when only a pair of replicates for a given sample. However, when there are 3 or more replicates, there are multiple pairwise comparisons possible, so we report relative standard deviation (RSD) instead as an indicator of the spread of the distribution in measurements. (The use of both RPD and RSD to measure precision follows SWAMP protocols.)

Accuracy

We estimate the lab’s accuracy, or the closeness of a measured result to an accepted reference value by measuring the percent recovery of a compound in a sample that is “spiked” with a known quantity of a chemical. Recoveries were evaluated from matrix spike samples, with average deviation less than the 25% target limit in the QAPP. Therefore, we did not flag any results for recovery problems. This provides evidence that the results of the lab analysis are reasonably accurate.

Comparison to previous data

As a final check on the data, we compare the results to those from similar studies, or to results from previous years. This is a qualitative check that lets us see whether results are out of the ordinary and may require some followup investigation. In general, the lab results for pesticide measurements were consistent with those found in year 1. Of the 10 analytes that were detected in more than half the samples in the first year, 6 were also found in more than half the samples in Year 2, and the remaining 4 were detected in between 25 to 50% of samples.

Other Analytes – DOC, POC, Copper, and TSS

The following section gives a summary of the QA for analytes other than pesticides. These include analyses performed by the USGS National Water Quality Laboratory (NWQL) in Denver, Colorado for dissolved organic carbon (DOC), particulate organic carbon (POC), and copper. This section also describes the QA for total suspended solids (TSS) analyzed by the Organic Chemistry Research Laboratory (OCRL) in Sacramento.

General findings and recommended actions

Nearly all of the field data were reportable for the target analytes. We did not reject or censor any data because of quality concerns, but two expected records were lost in processing and not reported by the lab, with insufficient material for reanalysis. Both missing records were for DOC. According to the lab manager, these samples were lost during sample processing at the NWQL. Reruns of the samples were requested but there was not enough sample material remaining. *To diagnose and help prevent future occurrences, reports should be sent to the PM after each sampling round with counts of all field samples and field QC provided to analytical labs. The data manager should also check preliminary submissions for counts (as well as other QC sample types) and confirm with submitting lab, to minimize piecemeal additions of missing data and reformatting/re-evaluation.* Matrix spike recoveries for copper were variable, despite good recoveries on lab control (blank) spikes, suggesting possible interference in analysis of natural matrix samples.

Hold time

Hold time was met for ~~most all~~ analyses ~~aside from 1 TSS sample, which was analyzed 33 days after collection, past the recommended 7 day hold time. This result was flagged for hold time exceedance by the lab (HT flag), but not censored. The organic portion of TSS is typically similar to that in sediment (<10% of total mass), so the impact of possible sample TSS degradation would likely be of that magnitude (<10%) so no added flags were needed.~~

Completeness

The dataset includes 60 site event combinations (12 months, 5 sites) for 2016–2017, reported for POC, copper, and TSS. The lab failed to report two expected results for DOC (~3% of the expected total). Missing samples were:

- At Ulatis Creek at Brown Road (site code 511ULCABR) on 2016-07-13
- At Mokelumne River at New Hope Road (site code 544SAC002) on 2016-08-17

The lab reported three or more filter blanks and laboratory control samples (LCSs), with the number of filter blanks varying by analyte, ~~but with all~~ meeting or exceeding the required 1 per 20 (5%) frequency in the QAPP, but not necessarily the “or batch” condition. Thus batches without blanks or recovery samples were therefore flagged in BatchVerificationCode “VOI” for incomplete QC. Blanks were nearly all non-detects, and recovery for most analytes met QAPP targets, so the impact of fewer QC samples may not be severe.

The lab only submitted only 2 MS/MSD pairs for copper. This is one less of each type of QA sample than specified in the QAPP. We have communicated this with the lab. There may have been confusion resulting from initial submission of the first 3 months of Year 2 data with Year 1, and erroneously counting of some of those samples as applying to Year 2.

Field replicates were reported (at 5% frequency, $n = 3$) for DOC, POC, and copper, and TSS, and 3 or more lab replicates (of field grab samples) were reported for copper and DOC. *The project manager should monitor the minimum number of field replicates noted by field crews, and the data manager should check preliminary submissions for counts (as well as other QC sample types) and confirm with submitting lab.*

Sensitivity

Methods were generally sufficient to quantify the target conventional and metal analytes in nearly all the samples; only total nitrogen, a non-target analyte was ND in 3% of samples.

Blank contamination

A trace amount of copper was detected in one of the filter blanks at 0.32 $\mu\text{g/L}$, just above the MDL of 0.2 $\mu\text{g/L}$. Since all field sample copper concentrations were at least 3x higher than the blank result in that batch (which contained the Dec 2016 and Jan 2017 samples), those results were flagged for blank contamination (VIP flag) but not censored.

Precision

Variation among TSS field replicates was greater than sought in the QAPP, averaging RPD ~31%, over the 25% target. The project manager should continue to work in conjunction with field crews and labs to discuss alternative sampling and subsampling methods and strategies to minimize variation in TSS. Otherwise, the variation in TSS may make it of limited use for interpreting site characteristics and processes. RPDs on replicates averaged less than 10% for DOC and copper, and less than 25% for POC, meeting the QAPP requirements. Precision on MS and laboratory control samples (LCS) replicates was similar or even better, averaging <10% RPD for both DOC and copper.

Accuracy

LCS recoveries were generally good for DOC, with average errors <10%, well within the targets specified in the QAPP. There were no LCS or other recovery samples for POC, but TPC (total particulate carbon) recoveries would be most analogous, and also averaged <10% error.

However, although average copper recovery in MS/MSD samples was 122%, it was variable, with average deviation of 32%, greater than the 25% target in the QAPP. Copper LCS samples had much better recovery, averaging 3% error, suggesting the problem is an interference found only in natural matrix samples. All copper results were therefore flagged but not censored for recovery deviations.

Dissolved and particulate phases

Of the conventional analytes, only organic carbon was analyzed in more than one fraction (dissolved and particulate). DOC was generally > POC, with median and mean ratios of around 5:1. However, a few samples had POC > DOC, which might be needed to interpret if anomalies are found in field data for pesticides and other pollutant chemicals at those sites.

Comparison to previous data

Average results for DOC and copper are consistent with those found in year 1, but POC and TSS averaged about 40% lower than prior results; since the latter are both particulate phase, similar/proportional differences would be expected.

Meeting Materials for Item 7

Memo

To: Delta RMP Technical Advisory Committee and Steering Committee

From: Matthew Heberger, Aquatic Science Center

Date: May 22, 2018 (revised September 10, 2018)

Re: Plan for Science Advisor Input in FY18/19

Background: The FY17/18 Workplan included a \$10,000 budget to cover honoraria and travel for up to 4 independent science advisors. The advisors would be selected by the Steering Committee with input from the TAC and would commit to a 3-4 year term. Having advisors work with the Program over multiple years is efficient because they will become familiar with the Program and be able to help with adaptive management and review technical reports. The Bay RMP uses this approach to have ongoing, independent peer review of plans and final reports. The science advisor program is *not* a formal program review. Nor do we expect a great deal of written material in the form of reports or papers.

At its May 11, 2018 meeting the Steering Committee requested additional details and a strategy on how we will work with our advisors and engage their expertise. This memo provides the job description that we shared with nominated advisors, and outlines a process to gather input from the advisors in FY18/19.

Job Description

The Delta RMP seeks to work with scientists who can lend their expertise according to our needs and their skills and interest. This includes reviewing proposed monitoring plans, draft reports, and other program documents and give comments on how they can be improved to better support the goals of the Delta RMP. We would like to have advisors attend one meeting per year in person, it could be a meeting of our Technical Advisory Committee, which is a single day usually from 10 am to 4, or a technical subcommittee meeting, which are typically a maximum of 3 to 4 hours long. Further, we would also expect advisors to be available for infrequent, and informal, consultations with program staff to answer questions or discuss technical matters by phone and email. It is difficult to give an exact estimate for time commitment, but will likely be on the order of 5 – 15 hours per quarter.

The science advisor program is *not* a formal program review. Nor do we expect a great deal of written material in the form of reports or papers.

In the winter of 2017, the SC and TAC agreed that the program's greatest need was for a statistical expertise. Beyond this, the SC and TAC identified three other areas of support: Environmental Statistics/Large Scale Monitoring Programs, Monitoring Design/Interpretation of Data, and Ecosystem Level Effects. Members of the TAC, SC, and technical subcommittees were

asked to nominate advisors. In May 2018, the SC confirmed the following advisors:

- **Statistics and Monitoring Design**
 - 1) Dr. Dennis Helsel, USGS and Practical Stats
 - 2) Dr. Neal Willits, UC Davis
 - 3) Dr. Thomas Grieb, TetraTech
 - 4) Steve Saiz, Central Valley Regional Water Quality Control Board
- **Toxicity / Pesticides / Contaminants**
 - 1) Dr. Lisa Nowell, USGS
 - 2) Dr. Gary Cherr, UC Davis

Curriculum vitae for our 6 advisors are included as an attachment to this memo.

Plan for Engaging Advisors

During FY18/19, the Science Advisors will be asked to provide input on:

1. The proposed Pesticide/Toxicity Monitoring Plan (spring/summer 2018)
2. Draft reports when they are sent to the TAC (ongoing)
3. Pesticides Interpretive Report
4. Proposed studies for FY19/20 (winter 2019)

For the FY19/20 proposed studies, the advisors will be asked to review proposals and attend the TAC meeting where all the proposals are discussed.

Project timelines and deliverables are shown on the following page for (1) the pesticides Interpretive Report being led by Deltares, and (2) monitoring and reporting for Water Years 2019 – 2022.

1. Science advisors can be invited to provide input into the interpretive report analysis through attending meetings where Deltares scientists present their proposed analysis methods and draft results.
2. Further, advisors can be invited to provide input on Delta RMP results and reporting that will help the program engage in “adaptive management” to collect the most useful information with available resources.
3. Finally, one or more advisors can be invited to the fall Joint Meeting of the SC and TAC to participate in the discussion of Long-Range Planning.

Pesticides Interpretive Report

Showing June 2018 – May 2019

Project month 1	1	2	3	4	5	6	7	8	9	10	11	12
task	June	July	August	Sept	oct	Nov	Dec	Jan	feb	Mar	April	May
1. stakeholder engagement & input												
1.1 meetings (M1.1, 1.2, M1.3, M1.4)	M1.1			M1.2D1.3		M1.3D.1.5					M1.4 D1.7	
1.2 response to meetings (M1.5, M1.6, M1.7, M1.8)		M1.5			M1.6 D1.4		M1.7 D1.6					M1.8 D1.8
2. compilation of existing data & literature												
2.1 summary and evaluation of existing data												
2.2 database of pesticide & toxicity data												
2.3 memo with basic data visualisations												
3. Analysis methods												
3.1 updated list of water quality objectives						D3.1						
3.2 draft method of analytical methods							D.3.2					
3.3 final method of analytical methods								D.3.2				
4. intepretive report												
4 analysis of data according to agreed methods												
4. Interpretive report						D.4.1				D.4.2		D.4.3

Milestones and Deliverables:

Milestone M.1.1 and M 1.5.: Kick off meeting (Month 1) and response to meetings

Milestone M1.3 - 1.8: Milestone meeting and response to comments

Deliverables: D1.3, D1.5 and D1.7: Presentation at meetings

Deliverables: D1.4, 1.6 and 1.8: Minutes of meetings with responses to meetings and deliverables presented

D 2.1: Summary of the definitive data set.

D 2.2: Excel file containing the definitive database with both pesticide and toxicity results to be used in further analysis.

D 2.3: Technical memo describing the principles, methodology and metadata used to construct the final database and displaying some basic visualizations.

D 3.2 Draft memorandum on analytical methods to be used

D 3.3: Final memorandum on analytical methods to be used

Timeline of activities and deliverables for Pesticides and Toxicity Monitoring

	2018						2019												2020				2021				2022				2023			
	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Task 0: QAPP Update		d	f																															
Task 1A: Year 1 Sampling																	d		f															
Task 1B: Year 1 Data mgmt and QA																			d	f														
Task 2A: Year 2 Sampling																						d	f											
Task 2B: Year 2 Data mgmt and QA																						d	f											
Task 3A: Year 3 Sampling																										d	f							
Task 3B: Year 3 Data mgmt and QA																										d	f							
Task 4A: Year 3 Sampling																														d	f			
Task 4B: Year 3 Data mgmt and QA																														d	f			
Task 5: Analysis and interpretation																																d	f	

D = Draft deliverable

f = Final deliverable

■ = Activity

Deliverables:

- Task 0: Amended QAPP, including detailed sampling and analysis plan
- Tasks 1A, 2A, and 3A: Year- end monitoring reports by USGS and AHPL
- Tasks 1B, 2B, 3B: QA Officer Memo, data uploaded to CEDEN
- Task 5: Detailed interpretive report including findings of 3-year sampling program and recommendations for future monitoring

CURRICULUM VITAE: Gary N. Cherr

Office Address

University of California Davis Bodega Marine Laboratory
PO Box 247
Bodega Bay, CA 94923
Office: (707) 875-2051
FAX: (707) 875-2009
E Mail: gnycherr@ucdavis.edu
<http://bml.ucdavis.edu/research/faculty/gary-cherr/>

Home Address

4971 Acacia Way
Penngrove, CA 94951
(707) 664-8284
Cell (707) 799-9947

Education and Training:

B.A. Biology, Sonoma State University, 1979
Ph.D. Zoology, University of California, Davis 1984
National Institutes of Health Postdoctoral Fellow, Department of Obstetrics and Gynecology,
School of Medicine, University of California, Davis, 1983-1986.

Areas of Specialization: reproductive physiology, reproductive and developmental biology and toxicology, sperm cell physiology, embryo defense mechanisms, biochemistry and cell biology of environmental stress, endocrine disruption, environmental toxicology, oil spill impacts

Current Appointments:

Director (2009-present), UC Davis Bodega Marine Laboratory
Professor (1999-present), UC Davis Departments of Environmental Toxicology and Nutrition

Professional Experience:

Acting Director, Bodega Marine Laboratory, 2007-2008
Research Biologist (1993-1999), Bodega Marine Laboratory and Dept. Environmental
Toxicology, University of California, Davis, 1999

Service: *University of California*

Study Section Member for Tobacco-Related Disease Research Program, Office of the President
of the University of California, 1990
Steering Committee for University of California at Santa Barbara, Southern California Education
Initiative, U.S. Department of Interior, 1990-1994
California Sea Grant College Program Advisory Board Member, 2003-present
California Sea Grant College Program Advisory Board Chair, 2005-present
University of California Marine Council, 2007-2008
Executive Board, Cooperative Institute for Marine Ecosystems and Climate (NOAA and UC San
Diego), 2011-2015.

Service: *Non-University*

Science Advisory Board, San Francisco Bay Estuary Project, 1988-1990
Biomonitoring Science Advisory Board, Department of Ecology, State of Washington, 1991-
1995
Advisor, US Regional Marine Research Board, Pacific Northwest Region, Washington State Sea

Grant College Program, 1992-1993
Protocol Review Committee, Water Resources Control Board, State of California, 1994-2000
Technical Review Panel, Department of Ecology, State of Washington, 1998
Toxicity Identification Evaluation Review Committee, US EPA, 1999-2000
Organizer of 2000 Western Regional Developmental Biology Conference, Society for
Developmental Biology, Bodega Marine Laboratory
Exxon Valdez Oil Spill Trustee Council Science Panel, 2006-present
State of California Resources Agency Science Sea Grant Advisory Panel, 2007-2010
Technical Advisory Committee, Coastal Conservancy Creosote Removal Project, 2014-present

Selected Publications (150 total):

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- Griffin, F.J., T. DiMarco, K.L. Menard, J.A. Newman, E.H. Smith, C.A. Vines, and G.N. Cherr. 2012. Impacts of suspended sediments on Pacific herring (*Clupea pallasii*) larval survival and condition. *Estuaries and Coasts*, 35(5):1229-1236.
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Cherr, G.N., E. Fairbairn, and A. Whitehead. 2017. Impacts of Petroleum-Derived Pollutants on Fish Development. *Annual Reviews of Animal Bioscience*, 5:185-203.

Miller, R., E. Muller, B. Cole, T. Martin, R. Nisbet, G. Bielmyer-Fraser, T. Jarvis, A. Keller, G. Cherr, H. Lenihan. 2017. Photosynthetic efficiency predicts toxic effects of metal nanomaterials in phytoplankton. *Aquatic Toxicology*, 183:85-93.

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Gary N. Cherr, Ph.D.
Curriculum Vitae

Keller, A.A., A.S. Adeleye, J.R. Conway, K.L. Garner, L. Zhao, G.N. Cherr, J. Hong, J.L. Gardea-Torresdey, H.A. Godwin, S. Hanna, Z. Ji, C. Kaweeteerawat, S. Lin, H. Lenihan, R. Miller, A.E. Nel, S.L. Walker, A.A. Taylor, C. Torres-Duarte, J. Zink, and N. Zuverza-Mena. 2017. Comparative environmental fate and toxicity of copper nanomaterials. *NanoImpact*, 7:28-40.

Torres-Duarte, C., K.M. Ramos-Torres, R. Rahimoff, and G.N. Cherr. 2017. Stage specific effects of soluble copper and copper oxide nanoparticles during sea urchin embryo development and their relation to intracellular copper uptake. *Aquatic Toxicology*, 189:134-141.

Santillán-Urquiza, E., F. Arteaga-Cardona, C. Torres-Duarte, B. Cole, B. Wu, M.A. Méndez-Rojas, G.N. Cherr. 2017. Facilitation of trace metal uptake in cells by inulin coating of metallic nanoparticles. *Royal Society of Open Science*, 4: 170480.



Thomas M. Grieb, Ph.D. Chief Scientist

EXPERIENCE SUMMARY

Dr. Grieb is chief scientist in Tetra Tech's Water Group, with 40 years of experience. His primary research interests include the behavior of mercury and other metals in the aquatic environment, and the application of statistical methods to characterize uncertainty in environmental data sets and simulation models.

RELEVANT EXPERIENCE

San Francisco Bay-Delta Methylmercury Control Studies. Chairman of the Technical Advisory Committee (TAC) for the Regional Water Quality Control Board's Methylmercury Control Studies. The purpose of these studies is to evaluate existing methylmercury control methods and develop additional control methods that could be implemented to achieve methylmercury load allocations. The TAC is composed of international experts in mercury methylation and demethylation processes, mercury cycling and transport, hydrology, wetland design and maintenance, agricultural practices and wastewater treatment processes and urban runoff management.

Systematic Review of Trends in Fish Tissue Mercury Concentrations. Since the 1970s there has been a major international effort to monitor mercury (Hg) concentrations in fish tissue to identify areas with fish Hg concentrations that are of concern to human health and wildlife. More recently, numerous data sets, based on these monitoring programs, have been compiled and used to evaluate trends in mercury in fish from both freshwater and marine systems. The study team is reviewing the academic literature and published government reports that assessed temporal trends in fish or invertebrate tissue mercury concentrations. The goals of the project are to summarize the overall trend patterns in fish tissue Hg concentrations, and to review and evaluate the statistical methods used for trend assessment. During the course of the review, the study team is recording information on the influence of other factors that affect the relationship between atmospheric Hg deposition and fish tissue Hg levels.

Lavaca Bay Superfund Site. Technical consultant for the development of a supplemental data collection effort to update and understand mercury methylation in the sediments and to improve the understanding of the process by which methylmercury bioaccumulates in the coastal food web. Sampling includes the measurement of the factors potentially controlling mercury methylation: total and methylmercury concentrations, chemical redox conditions, and

EDUCATION

Ph.D. Environmental Health Science, University of California, Berkeley

M.S. Biostatistics, University of California, Berkeley

M.A. Marine Biology, San Francisco State University

A.B. Zoology, University of California, Berkeley

REGISTRATIONS/ AFFILIATIONS

American Association for the Advancement of Science

OFFICE

Lafayette, CA

YEARS OF EXPERIENCE

40

YEARS WITH TETRA TECH

40

bioturbation. A simulation model BIOTURB was used to examine the effect of living organisms in the sediment on the observed vertical distribution of mercury, the burial of mercury in the sediments and the time to reach background conditions. The results of this work were reported in the 2016 Remedial Action Annual Effectiveness Report.

North San Francisco Bay Selenium TMDL. Tetra Tech provided technical support to facilitate the preparation of the Selenium TMDL that was completed by the California Regional Water Quality Control Board in 2016. This work was funded by the Western States Petroleum Association and included the source characterization and Se loading assessment, assessment of the toxicological effects of selenium on invertebrates, fish, birds and mammals, the development of a conceptual model of the processes that affect Se biogeochemistry, and the modeling of Se fate and transport in the Bay-Delta. Dr. Grieb was the project manager and works closely with the Water Board, U.S. EPA Region 9, an advisory committee representing a diverse stakeholder group, and the technical review committee, consisting of world experts in modeling, Se toxicity, and Se biogeochemistry

Expert Mercury Review Panel Member, San Francisco Bay-Delta Fish Monitoring Program (FMP). The FMP was a three-year project conceived in 2005 as an integrated mercury monitoring program intended to contribute to the reduction of the exposure of human and wildlife to methylmercury as rapidly and efficiently as possible.

Florida Mercury TMDL. The Florida Department of Environmental Protection (FDEP) developed a regional Hg TMDL specification for water bodies in the state. Tetra Tech supported the Florida Coordinating Group's efforts to work with FDEP in addressing key technical issues associated with the TMDL development. Key efforts included the development of a conceptual model and independent empirical and mechanistic analyses to provide a summary of best current scientific understanding that pertains to the Florida Hg TMDL.

Guadalupe River Watershed Mercury TMDL. The Guadalupe River Watershed has elevated mercury concentrations in sediment, stream banks, water and fish that resulted from past mercury mining that occurred in the New Almaden Mining District between 1845 and 1975. Except for releases from reservoirs, there are no direct discharges of mercury to the system that can be easily identified and treated to reduce the concentrations in the system. Instead there are multiple sources that are almost all related to past mining activities. Dr. Grieb was the project manager for this project that identified where the mercury is in the system, where it is being solubilized and methylated, and how the streams and reservoirs can be effectively remediated. The Conceptual Model of Mercury in the Guadalupe River Watershed was completed by Tetra Tech in December 2003. EPA Region 9 commented that "the report did an outstanding job of describing a complex situation and breaking it down into logical, definable and workable components, while simultaneously summarizing in detail what is known and unknown in each of the components".

South San Francisco Bay Copper and Nickel TMDL. Project manager for the Calculation of Total Maximum Daily Loads for Copper and Nickel in South San Francisco Bay. Tetra Tech led a diverse team of 12 organizations that conducted a successful 4-year, \$3.5 million effort with the goal of establishing a sound technical basis for municipal wastewater and stormwater permit requirements that are protective of beneficial uses, effective, and not prohibitively expensive. A modeling approach was incorporated into the TMDL development with five primary areas of effort: conceptual model development, stakeholder involvement, data collection and analysis, simulation modeling, and feasibility analysis. Scientifically-based, site specific water quality objectives were developed which have broad-based stakeholder support. Copper and Nickel Action Plans were part of a non-degradation strategy and were implemented in NPDES permits.

Global Carbon Cycle Model. Chief statistician for examination of model uncertainty and parameter interaction in the global carbon cycling model (GLOCO). A new tree-structured density estimation technique was used to explore parameter uncertainty and interaction in the global carbon cycle model GLOCO. The magnitude and sources of uncertainty were identified in a set of simulations aimed at establishing the relative importance of the terrestrial biome as a sink for atmospheric carbon. The combined effects of individual model parameters and the interactions between model parameters as well as the interaction between different submodels were examined. The use of these new uncertainty analysis techniques in the calibration of complex models with high spatial resolution was also addressed.

Monitoring Guidance. Participated in the development of 12 marine monitoring and statistical guidance documents for U.S. EPA. These documents were developed to guide the design and evaluation of monitoring programs as well as the assessment of short- and long-term impacts of municipal and industrial discharges on the marine environment. Principal author of the following technical support documents: Use of Statistical Power Analysis; and Bioaccumulation Guidance: Strategies for Sample Replication and Compositing. These documents describe the theory and application of statistical power analysis in a wide range of statistical test methods.

Application of Analysis of Variance Methods. Principal Investigator for the evaluation of robustness of the ANOVA statistical model to deviations from homogeneity of variance and normality in the distribution of dependent variables.

Monitoring Guidance for the National Estuary Program. Senior author for the Monitoring Guidance for the National Estuary Program. This document provided guidance on the design, implementation and evaluation of required monitoring programs. The document described a systems design strategy that emphasizes the assessment of tradeoffs between individual components of the monitoring program and the use of feedback mechanisms to modify monitoring procedures based on periodic assessments of overall program performance. The document also described the primary set of sampling and analysis methods that have been used in estuarine monitoring programs.

SCIENTIFIC/TECHNICAL PUBLICATIONS

- Chen, L., S.L. Meseck, S.B. Roy, T. M. Grieb, and B. Baginska. 2012. Modeling Fate and Transport of Selenium in North San Francisco Bay. *Estuaries and Coasts* 35(6):1551-1570.
- Roy, S.B., L. Chen, E. H., Girvetz, E. P. Maurer, W. B. Mills, T. M. Grieb. 2012. Projecting Water Withdrawal and Supply for Future Decades in the U.S. under Climate Change Scenarios. *Environ. Sci. Technol.*, 2012, 46 (5): 2545–2556
- Rigby, M.C., X. Deng, T. M. Grieb, S. J. Teh, S. O. Hung. 2010. Effect Threshold for Selenium Toxicity in Juvenile Splittail, *Pogonichthys macrolepidotus*. *Bulletin of Environmental Contamination and Toxicology*. 84(1):76-79.
- Conaway, C. H., F. J. Black, T. M. Grieb, S. Roy, A. R. Flegal. 2008. Mercury in the San Francisco Estuary. In: Whitacre, D. M. (ed.), *Reviews of Environmental Contamination and Toxicology*. Springer, pp 29-54.
- Yee, D., T. Grieb, W. Mills, M. Sedlak. 2007. Synthesis of long-term nickel monitoring in San Francisco Bay. *Environ. Res.* 105(1):20-33.
- Porcella, D.B., E. J. Zillioux, T. M. Grieb, J. R. Newman, and G. B. West. 2004. Retrospective study of mercury in raccoons (*Procyon lotor*) in South Florida. *Ecotoxicology*, 13 (3): 207-221

- Grieb, T.M., R. J. M. Hudson, N. Shang, R. C. Spear, S. A. Gherini and R.A. Goldstein. 1999. Examination of model uncertainty and parameter interaction in the Global Carbon Cycling Model (GLOCO). *Environment International*. 25(6/7): 787-803.
- Spear, R.C., T.M. Grieb, and N. Shang. 1994. Parameter uncertainty and interactions in complex environmental models. *Water Resources Research* 30(11):3150–3169.
- Bowie, G.L., T.M. Grieb, and D.B. Porcella. 1991. Modeling the effects of selenium in aquatic ecosystems. *Water, Air, and Soil Pollution*. 57: 13–22.
- Grieb, T.M., C.T. Driscoll, S.P. Gloss, C.L. Schofield, G.L. Bowie, and D.B. Porcella. 1990. Factors affecting mercury accumulation in fish in the upper Michigan peninsula. *J. Environmental Toxicology and Chemistry*. 9: 919–930.
- Gloss, S.P., T.M. Grieb, C.T. Driscoll, C.L. Schofield, J.P. Baker, D. Landers, and D.B. Porcella. 1990. Mercury levels in fish from the upper peninsula of Michigan (ELS Subregion 2B) in relation to lake acidity. U.S. Environmental Protection Agency. EPA/600/3-90/068.
- Grieb, T.M. 1985. Robustness of the analysis of variance in environmental monitoring applications. Electric Power Research Institute Report EA 4015. 79 pp.
- Pastorok, R.A. and T.M. Grieb. 1984. Prediction of lake response to induced circulation. In: *Lake Reservoir Management*. EPA 440/5/84-001.
- Porcella, D.B., G.L. Bowie, T.M. Grieb, and R.K. Kawaratani. 1983. Simulation and analysis of cooling lake ecosystem impacts from power plant operations. *Proceedings of the National Conference on Environmental Engineering (ASCE)*, Boulder, Colorado. pp. 797–804.
- Grieb, T.M., D.B. Porcella, T.C. Ginn, and M.W. Lorenzen. 1981. Classification and analysis of cooling impoundments: an assessment methodology using fish standing crop data. *Am. Soc. Civil Eng.* 2:482-94.
- Ginn, T.C., T.M. Grieb, D.B. Porcella, and M.W. Lorenzen. 1981. Limnological study of Lafayette Reservoir. EPA Report. EPA-600/3-81-009, 127. p.
- Grieb, T.M. and R.D. Beeman. 1978. Spermatogenesis in the market squid, *Loligo opalescens*. *California Department of Fish and Game Bulletin* 169. pp. 11–22.

Dennis R. Helsel
Practical Stats LLC
2838 Mashie Cir
Castle Rock, CO 80109
dhelsel@practicalstats.com

EDUCATION

Ph.D. Environmental Sciences and Engineering, Virginia Tech, Blacksburg. June 1978.

M. Sc. Geology (Geochemistry), University of Delaware, Newark. June 1976.

BA Geology, University of Rochester, Rochester NY. June 1973.

CURRENT POSITION

Principal Scientist, Practical Stats LLC (www.practicalstats.com).

Statistical consultant. Designs and conducts training courses and webinars in environmental statistics for scientists.

As a 'subcontractor', performs data analysis, provides unbiased review and advice on statistical models and reports.

Publishes articles on innovative methods in environmental statistics. Provides unbiased expert witness testimony.

Past projects include analysis of water withdrawal effects on biota, alternate methods rather than regression for biotic models, regional projections of natural water quality conditions, review of stormwater impact analyses on receiving waters, levels of cryptosporidium and giardia in a major city's water supply, trace element data analysis in moss and plants, and a real-time groundwater vulnerability model using logistic regression for the probability of contamination. Reviews of work for statistical guidance include review of trend analysis efforts on major rivers of a Canadian Province for the provincial government, reviews of statistical procedures for sediment quality regulations of a State regulatory agency, and review of guidance of statistical procedures for health assessments for a Federal health agency. Other projects include devising a groundwater monitoring plan for a waste site based on the USEPA's Unified Guidance. I have provided technical consulting services to major corporations and government agencies within and outside the United States.

Recent training conducted includes courses and webinars on Applied Environmental Statistics, Analysis of Censored (Nondetect) Data, and Statistics for Contaminated Sites. I have conducted training directly to staff of state agencies including the California Water Resources Division, federal agencies such as the US Environmental Protection Agency, universities such as the Univ. of West Florida, and companies such as ExxonMobil. See more detail below.

I co-authored *Statistical Methods in Water Resources* (USGS, 2002), a textbook now used by university, industry and government scientists for guidance in analysis of their data. For example, the State of California has used the book as its manual for statistical methods in support of coastal water quality. I recently completed a second edition of the book along with my co-authors, bringing the work up to date using R software. I've published statistical analyses of dioxins and furans in soils; mercury, arsenic and other trace elements, nutrients, herbicides, MTBE and perchlorate in water; regression models for debris flows of mud in burned areas of the western U.S.; and mercury concentrations in fish. For 30 years I pioneered work in environmental studies for the U.S. Geological Survey, including studies of precipitation chemistry and nonpoint sources in 1978, load estimation programmed on a 'personal computer' in 1982, and methods for interpretation of nondetect data in the 1980s. In my current job I advise a variety of scientists in biology, geology and water resources to improve their abilities to extract information from data.

NOTABLE ACCOMPLISHMENTS

TEXTBOOK ON INTERPRETING ENVIRONMENTAL DATA WITH NONDETECTS

The methods in my textbook *Statistics for Censored Environmental Data* (2012) -- the 1st edition was titled *Nondetects And Data Analysis* (2005) -- are changing the way that trace-contaminant data in water, air, rocks, soil, and biota are interpreted.

EDITORIAL BOARD MEMBER, Applied NAPL Science Review (journal). 2014 – 2017.

INVITED PLENARY SPEAKER, 6TH INTERNATIONAL CHEMOMETRICS RESEARCH MEETING. September 2014, Nijmegen, Netherlands. I presented original methods for computing multivariate analyses on data with nondetect observations.

HONORS

DISTINGUISHED ACHIEVEMENT AWARD, AMERICAN STATISTICAL ASSOCIATION

I received the Distinguished Achievement Award from the Section on Statistics and the Environment, American Statistical Association, August 2003. *This award is given to only one or two statisticians each year who have made an impact on the theory or practice of environmental statistics.*

Distinguished Service Award, US Department of the Interior, 2007. Highest award given by the Dept. of Interior.
Meritorious Service Award, US Department of the Interior, 1996

PREVIOUS PROFESSIONAL EXPERIENCE

Statistician, US Geological Survey (11/2001 - 4/2008)

Lead scientist on data analysis methods, statistical modeling and experimental design. I developed new methods for modeling and data analysis, and incorporated newly developed methods from other disciplines to improve the statistical protocols used within the U.S. Geological Survey. I worked with a team to design a soil chemistry sampling network for North America (Canada, the U.S. and Mexico).

Associate Regional Geologist, Central Region, USGS (05/01 – 11/01)

As the Associate Regional Geologist, I led the annual science planning process for geologists in the USGS Central Region. I worked with other Federal agencies (NPS, BLM, EPA) and State Geologists to develop opportunities for joint work

Chief, Trace Element Synthesis, USGS National Water Quality Assessment (NAWQA) Program (02/97-05/01)

Created and headed a team to interpret trace element data for the USGS national program. Our results on arsenic in groundwater across the United States were used by many agencies and reported on in many news outlets, including CNN. Helped to design a cooperative study with the National Cancer Institute investigating cancer occurrences in relation to arsenic concentrations in the public and private drinking water supplies of New England.

Coordinator, USGS Drinking Water Initiative (11/95-01/97)

Promoted USGS activities related to drinking water. Developed methods for using logistic regression in ground water vulnerability studies, and taught these techniques to other USGS scientists. Worked closely with the Association of State Drinking Water Administrators (ASDWA), US EPA's Office of Ground Water and Drinking Water, the American Water Works Assoc. (AWWA), the National Association of Water Companies (NAWC), the Centers for Disease Control and Prevention, and other health officials and organizations.

OTHER CAREER ACCOMPLISHMENTS

INTERNATIONAL TRAINING COURSES

CANADA 2017, 2016 – Invited to train staff of Alberta Environment and Parks, AEMERA, and Environment Canada and Climate Change (four separate courses) on applied statistics and multivariate statistics.

SINGAPORE 2013, 2011 – Invited to train staff of the PUB, Singapore Ministry of Water and Environment, on applied statistics, multivariate statistics, and interpretation of censored data.

QATAR 2012 – Invited by ExxonMobil Qatar to train staff of national ministries, universities and ExxonMobil research staff on applied statistics.

EUROPE 2007 – Invited to teach a two-day course on interpretation of censored data using R at the Helsinki Institute of Technology, Finland, and to the Umweltbundesamt (German Environment Agency), Berlin, Germany.

CYPRIT SCIENTISTS, 2001 - 2002 -- Planned and conducted two week-long training courses on applied statistics to Cypriot (both Greek and Turkish heritage) scientists, held in Europe.

ISRAEL, 1999 – Developed and taught a one-week training course on applied statistics to scientists from Israel, the West Bank, Gaza, and Jordan, as part of the Multilateral Working Group on Water Resources of the Middle East Peace Process. Culminated in a joint report on the Region's water supplies, one of a very few jointly authored reports between scientists from throughout the Middle East.

CHINA 1990 –Two-week training course on applied statistics in Beijing, China, June 1990. Scientists from the Ministry of Water Resources offices throughout China were selected to attend the course. I designed the course, prepared all materials, and taught the course through an interpreter, a professor from Beijing University.

CHINA, 1988 – Invited to deliver lectures on interpretation of water quality data to eight offices of the Ministry of Water Resources, Peoples Republic of China. As a result of these lectures, a formal agreement was established to teach an entire course on the topic two years later.

INVITED LECTURES

2016	<i>Nondetects And Data Analysis</i>	National Water Quality Monitoring Council
2015	<i>Overcoming Uncertainty With Modern Statistical Tests: what you learned in college is probably obsolete</i>	Society for Freshwater Science Annual Meeting.
2014	<i>Chemometrics for Data With Values Below the Detection Limit</i>	6 th Intl Chemometrics Research Mtg. Royal Netherlands Chemical Society.
2012	<i>Statistics for Contaminated Sites</i>	Health Canada & Canadian Society of Contaminated Sites Approved Professionals of British Columbia
2011	<i>It Ain't Necessarily So: Urban Legends in Environmental Statistics.</i>	USEPA Quality Conference
2010	<i>Interpreting Nondetect Data Correctly</i>	Groundwater Resources Association of California
2010	<i>Man vs. Stats</i>	N. Am. Lake Management Society conference
2009	<i>Interpreting Nondetect Data Correctly</i>	SETAC, Rocky Mountain Chapter
2009	<i>Time Series and Forecasting</i>	Hawaii Volcano Observatory, USGS
2008	<i>Nanostatistics</i>	American Statistical Assoc. National Conference
2007	<i>Trends in Trend Analysis</i>	Trinity College, Dublin, Ireland
2007	<i>Correctly Handling Nondetect Data</i>	NARPM Training Conference, US EPA
2006	<i>Analysis of Environmental Data With Nondetects</i>	American Stat. Assoc. National Conf.
2005	<i>Interpreting Data with Nondetects</i>	Managing Quality Systems, US EPA National Conf.
2004	<i>UCL95 for data below detection limits</i>	California Dept. of Toxic Substances Control
2002	<i>Touring data in one to three dimensions</i>	Groundwater Resources Association of California

ASSOCIATE EDITOR

Applied NAPL Science Review 2014-2017
Water Resources Research, 1994-96
Environmental and Ecological Statistics, 1992-94

SELECTED PUBLICATIONS (a full list of 50+ publications is available on request)

1. Helsel, D.R., R.M. Hirsch, S.A. Archfield, K.R. Ryberg and E.J. Gilroy, 2018, *Statistical Methods in Water Resources, Second Edition. USGS Techniques and Methods [number not yet assigned]*, 799 p.
2. Helsel, D.R., 2012. *Statistics for censored environmental data using Minitab and R, 2nd edition*. John Wiley and Sons, New York. 344 p.
3. Helsel, D.R., 2010, Summing Nondetects. *Integrated Environ Assess and Monitoring* 6, 361-366.

4. Helsel, D.R., 2010, Much Ado About Next to Nothing: Incorporating Nondetects in Science. Invited Commentary, *Annals of Occupational Hygiene* 54, 257-262.
5. Helsel, D.R., 2008. Detection Limits, in Brian Everitt and Ed Melnick, eds, *Encyclopedia of Quantitative Risk Analysis and Assessment*. Wiley.
6. Ayotte, J.; Argue, D.; McGarry, F.; Degnan, J.; Hayes, L.; Flanagan, S.; and Helsel, D., 2008. Methyl tert-Butyl Ether (MTBE) in Public and Private Wells in New Hampshire: Occurrence, Factors, and Possible Implications. *Environmental Science and Technol.* 42 (3), 677–684.
7. Helsel, D.R. and Frans, L.M., 2006. The Regional Kendall test for trend. *Environmental Science and Technol.* 40 (13), 4066 - 4073.
8. Helsel, D.R., 2005. More Than Obvious: Better methods for interpreting nondetect data. *Environmental Science and Technol.* 39 (20), 419A–423A.
9. Lee, L, and D. R. Helsel, 2005. Baseline models of trace elements in drinking water of the United States. *Applied Geochemistry* 20, 1560-1570.
10. Focazio, M.J., T. E. Reilly, M. G. Rupert, and D. R. Helsel, 2003; Assessing ground-water vulnerability to contamination: Providing scientifically defensible information for decision makers, *USGS Circular* 1224, 40 p.
11. Helsel, Dennis. R. and Robert M. Hirsch, 2002, *Statistical Methods in Water Resources, USGS Techniques of Water Resources Investigations, Book 4, Chapter A3*, 510 p.
12. Welch, A.H., D. B. Westjohn, D. R. Helsel and R. B. Wanty, 2000, Arsenic in Ground Water of the United States: Occurrence and Geochemistry, *Ground Water* v. 38 (4), 589-604.
13. Francy, D.S., D.R. Helsel, and R. A. Nally, 2000, Occurrence and Distribution of Microbiological Indicators in Groundwater and Stream Water, *Water Environment Research*, vol. 72 (2), 152-161.
14. Nolan, B.T., Ruddy, B.C., Hitt, K.J., and Helsel, D.R., 1997, Risk of Nitrate in Groundwaters of the United States --A National Perspective, *Environ. Sci. Technol.* 31, 2229-2236.
15. Mueller, D.K., and Helsel, D.R., 1996, Nutrients in the Nation's water--Too much of a good thing?: *U.S. Geological Survey Circular* 1136, 24 p.
16. Hirsch, R. M., Helsel, D. R., Cohn, T. A. and Gilroy, E. J., 1993, Statistical Analysis of Hydrologic Data, Chapter 17 in the *Handbook of Hydrology*, David R. Maidment, Editor in Chief, McGraw-Hill, Inc., New York.
17. Helsel, Dennis R., 1990, Less Than Obvious: Statistical Treatment of Data Below the Detection Limit, *Environmental Science and Technology* 24(12), 1766-1774.
18. Helsel, Dennis R., 1987, Advantages of nonparametric procedures for analysis of water quality data, *Journal Hydrological Sciences*, 32(2), 179-190.

Lisa H. Nowell, Ph.D.

U.S. Geological Survey
6000 J Street, Placer Hall
Sacramento, CA 95819

ph: (916) 278-3096
fax: (916) 278-3071
cell: (530) 902-2770
email: lknowell@usgs.gov

SUMMARY OF QUALIFICATIONS

Dr. Lisa Nowell is a research chemist at the U.S. Geological Survey (USGS), working in the National Water-Quality Program, National Water-Quality Assessment (NAWQA) Project. Her research and expertise combine aspects of environmental chemistry, stream hydrology, contaminant ecotoxicology, and environmental health and risk assessment, with a focus on pesticides. In 2013, she joined the newly created NAWQA Regional Stream-Quality Assessment (RSQA) team, which conducts multidisciplinary, regional-scale assessments of rivers and streams; interprets and models the occurrence of contaminants and other chemical stressors; and evaluates data on aquatic toxicity and ecological condition in relation to stressors. She has worked on the design and implementation of NAWQA since 1991, when she joined the USGS to work on NAWQA's Pesticide National Synthesis team. There she was the lead team scientist for assessing the ecological significance of pesticides and other contaminants in all environmental media, and served as a NAWQA-wide discipline expert in environmental organic chemistry. Dr. Nowell's research accomplishments include characterization of complex mixtures of contaminants in streams and assessing potential for toxicity; interpretive analyses of contaminant distributions in streams in relation to contaminant properties and sources and to watershed characteristics, including development of predictive models; and development and application of benchmarks and other tools for assessing potential effects of contaminants on human health, aquatic life, and wildlife.

EDUCATION

- 1985 **Ph.D.** Agricultural and Environmental Chemistry, University of California, Davis, CA.
- 1979 **M.S.** Ecology, University of California, Davis, CA.
- 1974 **B.A.** Human Biology, Stanford University, Stanford, CA.

PROFESSIONAL WORK EXPERIENCE

1/2013 to present; Research Chemist; U.S. Geological Survey, National Water-Quality Program, National Water-Quality Assessment (NAWQA), Regional Stream Quality Assessment team, Sacramento, CA.

Highlights:

- Lead scientist in analyzing complex mixtures of dissolved pesticides and their potential toxicity to aquatic life in small streams in five regions of the U.S. (2013-present).
- Lead role, as member of the Regional Stream Quality Assessment team, in the design and execution of five regional studies of stream quality; interpretation of chemical and biological data; modeling of contaminant occurrence in relation to watershed characteristics; effects of contaminants and other stressors on water and sediment toxicity and ecological condition in streams (2013-present).
- Co-lead in developing sediment benchmarks and a Sediment Pesticide Toxicity Index, tools for evaluating the potential toxicity of mixtures of current-use pesticides in bed sediment. (2013-2016)
- Co-lead in updating (version 3) and expanding the Pesticide Toxicity Index (PTI); application of the updated PTI in NAWQA study planning for upcoming regional studies. (2012-2014)

5/1991 – 6/2012, Research Chemist / Chemist; U.S. Geological Survey, National Water-Quality Assessment Program (NAWQA), Pesticides National Synthesis (PNS) Project, Sacramento, CA.

Highlights:

- Lead scientist for the analysis of organic contaminants, nutrients, and trace elements in beach water and sediment in response to the 2010 Deepwater Horizon oil spill in the Gulf of Mexico. (2010-2013)
- Co-lead in interpretative analysis of organic contaminants and trace elements in stream sediments in a collaborative USGS study of sediment chemistry and toxicity in seven metropolitan areas. Collaborators were from NAWQA, the Toxic Substances Hydrology Program, and Columbia Environmental Research Center. (2007-2013)
- Co-lead in characterizing contaminant mixtures in bed sediment in streams across the U.S., 1992–2001, using multiple approaches, including multivariate techniques and identification of unique mixtures; assessed potential for toxicity to benthic organisms. (2007-2010)
- Lead in developing regression models for predicting organochlorine pesticide concentrations in whole fish as a function of watershed characteristics; applied these models to make predictions for unmonitored streams across the U.S. (2006-2009)
- Co-lead in interpretative analysis of the effects of urbanization on dissolved pesticides in stream water from six metropolitan areas in the U.S. (2005–2008)
- Lead in national-scale analysis of organochlorine pesticides and polychlorinated biphenyls (PCB) in stream sediment and fish, and polycyclic aromatic hydrocarbons (PAH) in sediment, NAWQA Cycle 1, 1992–2001. (1996-2006)
- Participated in update (version 2) of the Pesticide Toxicity Index (PTI), a tool to assess the relative potential toxicity of pesticide mixtures in water to aquatic life. (2005-2006)
- USGS lead, in collaboration with the U.S. Environmental Protection Agency (USEPA), in developing new aquatic-life benchmarks for pesticides in water. Managed contract for aquatic toxicity data retrieval and analysis, and development of searchable database and web site. Benchmarks were derived for both acute and chronic exposure and for freshwater fish, invertebrates, and vascular and nonvascular plants. These benchmarks were subsequently (2007) adopted by USEPA and released as Office of Pesticide Programs Aquatic Life Benchmarks. (2004-2006)

- Representative of NAWQA Pesticide National Synthesis in an interagency effort to develop Health-Based Screening Levels (HBSL) for use in interpreting NAWQA water-quality data in a human-health context; co-author in pilot effort to apply the new HBSLs in interpreting data on contaminants in ground water in New Jersey. This effort was a collaboration between NAWQA, USEPA, New Jersey Department of Environmental Protection, and Oregon Graduate Institute. (2001-2003)
- Active in planning the study design for the national NAWQA Program, including all three Cycles of NAWQA; most recently, appointed to the Cycle 3 Surface Water Contaminants workgroup and Cycle 3 Implementation team for ecological effects. (1991, 2000, 2010-2012)
- Member of the USGS National Target Analyte Strategy (NTAS) committee, which prioritized chemicals for USGS analytical method development; co-lead of the NTAS subcommittee on lipophilic compounds. (2009-2012)
- Provided technical consultation and input to scientists from the USGS, the Bureau, outside agencies and organizations and the general public. Frequently consulted for technical guidance on contaminant benchmarks, interpreting water-quality data, and pesticides in streams. Guidance provided ranges from detailed technical assistance (providing datasets, data analysis, or document review) to answering questions and giving direction to appropriate resources. Examples of detailed assistance include: technical reviews of reports in support of the interagency Operational Science Advisory Team on the Deepwater Horizon oil spill (2011) and the U.S. Bureau of Reclamation (2007); data and technical guidance to the National Park Service for assessing transport and potential effects of pesticides applied to land adjacent to a national park in Hawaii (2006-2008); review of aquatic-life benchmark values from USEPA's Office of Pesticide Programs (2007, 2009); and data and technical guidance to The Heinz Center for Science, Economics and the Environment, for use in the "State of the Nation's Ecosystems" reports (2000-2001, 2006-2007).
- First author of the book, "Pesticides in Stream Sediment and Aquatic Biota—Distribution, Trends, and Governing Factors," published by CRC Press (1999). This book represents a comprehensive summary of existing knowledge at the time about sources, occurrence, transport, fate, and effects of pesticides in stream sediments and fish tissue.

1/1988 – 3/1991. Environmental Scientist, Environmental Impact Section, U.S. Food and Drug Administration (FDA), Washington, DC.

- Conducted environmental assessments of FDA-regulated chemicals under the National Environmental Policy Act (NEPA).
- Developed protocol for evaluating photochemical degradation of FDA-regulated chemicals.

1/1986 – 12/1987. Postdoctoral Research Scientist, Swiss Federal Institute for Water Resources and Water Pollution Control (EAWAG), Dübendorf, Switzerland.

- Conducted research on photolysis of aqueous chlorine; reactions of iron, aqueous ozone, and contaminants in water; secondary oxidants in water and their reactions with organic contaminants.

6/1986 – 8/1986. American Association for the Advancement of Science (AAAS) Fellow in Environmental Science and Engineering, Office of Research and Development, U.S. Environmental Protection Agency, Washington, DC.

- Wrote review paper, “Chloroform: Tumor promoter or complete carcinogen?”

6/1984 – 8/1984, 6/1985 – 7/1985. Environmental Scientist, Environmental Impact Section, U.S. Food and Drug Administration (FDA), Washington, DC.

- Conducted environmental assessments of FDA-regulated chemicals under the National Environmental Policy Act (NEPA).

1980 – 1985. NIEHS Trainee/Research Assistant/Teaching Assistant, Department of Environmental Toxicology, University of California, Davis, CA.

- Conducted research on photochemical degradation of organic contaminants in water, and reactions of organic contaminants in chlorinated water.

OTHER QUALIFICATIONS

Honors and Awards

- Nowell et al. (2018) selected as Editor’s Choice, Science of the total Environment (<https://www.journals.elsevier.com/science-of-the-total-environment/editors-choice>)
- USGS Research Grade Evaluation Promotion (2017)
- USGS Individual Performance Award (2017)
- USGS Individual Performance Award (2016)
- USGS Individual Performance Award (2015)
- USGS Individual Performance Award (2014)
- USGS Individual Performance Award (2013)
- USGS Research Grade Evaluation Program (2012)
- USGS Group Performance Award and Individual Performance Award, for Deepwater Horizon oil spill investigation (2012)
- Special Thanks for Achieving Results (STAR) Award, USGS (2011)
- Special Thanks for Achieving Results (STAR) Award, USGS (2010)
- Special Thanks for Achieving Results (STAR) Award, USGS (2009)
- USGS Superior Achievement Award (2007)
- Eugene M. Shoemaker Award for External Communications (with co-authors) for USGS Circular 1291, “Pesticides in the nation's streams and ground water—1992-2001 (2007)
- Special Thanks for Achieving Results (STAR) Award, USGS (2006)
- Special Thanks for Achieving Results (STAR) Award for additional duties taken on during Project Chief’s year-long absence, USGS (2003)
- Special Thanks for Achieving Results (STAR) Award, USGS (2001)
- Special Thanks for Achieving Results (STAR) Award, USGS (1999)
- American Association for Advancement of Science (AAAS) Fellow in Environmental Science and Engineering at USEPA (1985)

- Earle C Anthony Fellow in Agricultural and Environmental Chemistry, University of California (1979–1985)
- Regents Fellow in Ecology, University of California (1977–1979)

Professional Affiliations

- American Chemical Society (1980 to present)
 - Agrochemicals Division
 - Environmental Chemistry Division
- Society of Environmental Toxicology and Chemistry (SETAC) (1985 to present)
 - Program Committee, which is organizing the SETAC North America Annual Meeting to be held in Sacramento, November, 2018 (2017-present)
 - Meetings Committee (2017-present)
 - Global Sediment Advisory Group (2012-present). Chaired Data Quality subcommittee of committee developing SETAC database of spiked-sediment bioassay data. (2015)
 - Chemistry Advisory Group (2013-present)
 - Northern California chapter: Board of Directors (2013-2016); Secretary (2013-2014); Treasurer (2015-2016). Organized four regional chapter Annual Meetings. (2013-2016)
 - SoCal Toxicology Assessment Group (2012-2016)
 - Awards and Fellowship Committee (2013)
- American Geophysical Union (2014-present)

Technical Training

- Analytical organic chemistry; environmental chemistry; quality assurance/quality control; field methods for sediment, fish, and habitat sampling; statistics, including multivariate, censored data, and nonparametric methods; computer software, including Microsoft Word, Excel, Access, PowerPoint, TIBCO S-Plus, R, DataDesk, SigmaPlot; CPR and First Aid

Additional Experience

- Associate Editor, *Human and Ecological Risk Assessment: An International Journal* (2014-present)
- Editorial Board, *Human and Ecological Risk: An International Journal*. (2011-2014)
- AAAS Symposium Proposal Reviewer, AAAS Annual National Meetings (2013-2017)
- Reviewer for “Methodology for Derivation of Pesticide Sediment Quality Criteria for the Protection of Aquatic Life,” by University of California, Davis, for the State of California Central Valley Regional Water Quality Control Board. (2013)
- Reviewer for “Summary Report for Sub-Sea and Sub-Surface Oil and Dispersant Detection: Toxicity Addendum,” a report by the interagency Operational Science Advisory Team on oil-related contaminant data and effects on the Gulf of Mexico coast, especially with regard to use of USGS data and application of benchmarks. (2011)
- Peer reviewer for multiple journals (4–10 reviews per year): BioScience, Chemosphere, Conservation and Ecology, Ecological Indicators, Ecology and Society, Ecotoxicology and Environmental Safety, The Environmentalist, Environmental Pollution, Environmental Monitoring and Assessment, Environmental Research, Environmental Science and Technology, Environmental Toxicology and Chemistry, Environmental Toxicology and Pharmacology, Human and Ecological Risk Assessment, Journal of Environmental Analytical Chemistry, Journal of Environmental Quality, Pest Management Science, Science of the Total Environment.

- USGS internal peer reviewer (2-8 reviews per year): My reviews have included major NAWQA national-scale papers for journal publication, book chapters, USGS circulars, and NAWQA Study Unit Summary Reports.
- Research liaison between the USGS National Water Quality Program and the USEPA Office of Pesticide Programs for collaborative projects involving pesticides in surface water. (2016-present)
- Invited speaker representing USGS NAWQA Program at USEPA-USGS Pesticide Day, U.S. Environmental Protection Agency, Office of Pesticide Programs, Arlington, Virginia, March 31, 2016. Presented “Overview of Recent NAWQA Pesticide Studies;” “Pesticide Trends in Streams;” and “Landscape, Stressors, and Ecology.”
- Invited speaker in training course on “Pesticides and Water Quality” for State and Tribal pesticide regulators held by the Pesticide Regulatory Education Program (PREP), Davis, CA. Presented “Updates from USGS National Ambient Water Quality Assessment Program: Trends in pesticide use and occurrence,” April 8, 2014.
- Invited speaker, Environmental Toxicology 190/290, Environmental Chemistry and Toxicology, University of California, Davis, May 25, 2012.
- Invited participant, Pellston Workshop on Problem Formulation for Ecological Risk Assessments, Society for Environmental Toxicology and Chemistry, Pensacola, FL, April 18-23, 2010.
- Collaborated with Professor Song Qian, Duke University, to develop contaminant data for use in a graduate-level environmental statistics class, and to advise graduate students (2009)
- Invited participant during development of community-level pesticide benchmarks as part of a pilot project by Minnesota Pollution Control Agency Minnesota Department of Agriculture/USEPA Region 5 (2008-2009)
- Invited speaker in training course on “Pesticides and Water Quality” for State and Tribal pesticide regulators held by the Pesticide Regulatory Education Program (PREP), Davis, CA. Co-presented “Use of aquatic-life benchmarks and reference points for pesticides” with T. Steeger of USEPA, September 9, 2008.
- Invited speaker, California State Department of Pesticide Regulation: Presented “Pesticide concentrations in streams at low flow in seven metropolitan areas in the U.S.,” May 20, 2008
- Invited speaker, State FIFRA Issues Research and Evaluation group (SFIREG), Meeting of the Working Committee on Water Quality and Pesticide Disposal. Co-presented “Pesticides in streams in seven U.S. metropolitan areas,” with L. Sprague, May 5, 2008.
- Participant in Federal Interagency Workshop on Endocrine Disruption in the Environment, Committee on Environment and Natural Resources, National Science and Technology Council, Reston VA. February 20–22, 2007.
- Invited guest lecturer in Chemistry 195/295, Careers in Chemistry, University of California, Davis, October 26, 2007.
- Member of NAWQA Contaminant Effects Workgroup, which was tasked with developing contaminant sampling and assessment strategies for NAWQA (2002, 2007).
- Invited keynote speaker in training course on “Pesticides and Water Quality” for State and Tribal pesticide regulators held by the Pesticide Regulatory Education Program (PREP), Davis, CA. Presented “Pesticides in the Nation’s streams and ground water, 1992-2001,” August 15, 2006.
- Member of USGS Human Health Coordinating Committee Workgroup on Human Consumption of Bioaccumulative Contaminants. Identified USGS studies related to human health and helped to create several websites on USGS human health related activities. (2004–

2006)

- Collaborated with Dr. Dennis Helsel, Practical Stats, on a NAWQA dataset on DDT in fish for use in textbook (Nondetects and Data Analysis) and training classes. (2005)
- Member of the USGS Biomonitoring Status and Trends Technical Steering Team. (2004)
- Research Assistant/Teaching Assistant, Human Biology Department, Stanford University, Palo Alto, CA. Data analysis on behavior of wild baboons. (1974–1976)
- Undergraduate Research Assistant, Gombe National Park, Tanzania, and Stanford University, Stanford, CA. Field research on behavior of wild baboons. (1973–1974)

PUBLICATIONS

1. Nowell, Lisa H., Moran, Patrick W., Schmidt, Travis S., Norman, Julia E., Nakagaki, Naomi, Shoda Megan E., Mahler, Barbara J., Van Metre, Peter C., Stone, Wesley W., Sandstrom, Mark W., Hladik, Michelle L., 2018. Complex mixtures of dissolved pesticides show potential aquatic toxicity in a synoptic study of Midwestern U.S. streams. *Science of the Total Environment* v. 613-164, p. 1469–1488. <http://dx.doi.org/10.1016/j.scitotenv.2017.06.156>. Selected as Editor's Choice.
2. Garrett, Jessica D., Frey, Jeffrey W., Van Metre, Peter C., Journey, Celeste A., Nakagaki, Naomi, Button, Daniel T., and Nowell, Lisa H., 2017, Design and methods of the Midwest Stream Quality Assessment (MSQA), 2013: U.S. Geological Survey Open-File Report 2017–1073, xx p., <http://dx.doi.org/10.3133/ofr20171073>
3. Moran, Patrick W., Nowell, Lisa H., Kemble, Nile E., Mahler, Barbara J., Waite, Ian R., Van Metre, Peter C., 2017. Influence of sediment chemistry and sediment toxicity on macroinvertebrate communities across 99 wadable streams of the Midwestern USA. *Science of the Total Environment*, vol. 599-600, p. 1469-1478. <http://dx.doi.org/10.1016/j.scitotenv.2017.05.035>
4. Mahler, Barbara J, Van Metre, Peter C., Burley, Thomas E., Loftin, Keith A., Meyer, Michael T., Nowell, Lisa H., 2017, Similarities and differences in occurrence and temporal fluctuations in glyphosate and atrazine in small Midwestern streams (USA) during the 2013 growing season. *Science of the Total Environment*, vol. 579, p. 149-158. <https://doi.org/10.1016/j.scitotenv.2016.10.236>
5. Van Metre, Peter C., Alvarez, David A., Mahler, Barbara J., Nowell, Lisa, Sandstrom, Mark, Moran, Patrick, 2017. Complex mixtures of pesticides in Midwest U.S. streams indicated by POCIS time-integrating samplers: *Environmental Pollution* 220A:431-440. <http://dx.doi.org/10.1016/j.envpol.2016.09.085>
6. Shoda, Megan E., Stone, Wesley W., and Nowell, Lisa H., 2016, Prediction of pesticide toxicity in Midwest streams: *Journal of Environmental Quality* 45(6):p. 1856-1864. <http://dx.doi.org/10.2134/jeq2015.12.0624>
7. Nowell, L.H., Norman, J.E., Ingersoll, C.G., Moran, P.W., 2016, Development and application of freshwater sediment-toxicity benchmarks for currently used pesticides: *Science of the Total Environment*, vol. 550, p. 835–850. <https://doi.org/10.1016/j.scitotenv.2016.01.081>
8. Nowell, L.H., Norman, J.E., Moran, P.W., Martin, J.M., and Stone, W.W., 2014, Pesticide Toxicity Index—A tool for assessing potential toxicity of pesticide mixtures to freshwater

- aquatic organisms: *Science of the Total Environment*, vol. 476-477, p. 144-157.
<https://doi.org/10.1016/j.scitotenv.2013.12.088>
9. Nowell, L.H., Moran, P.W., Gilliom, R.J., Calhoun, D.L., Ingersoll, C.G., Kemble, N.E., Kuivila, K.M., Phillips, P.J., 2013, Contaminants in stream sediments from seven U.S. metropolitan areas: I. Distribution in relation to urbanization: *Archives of Environmental Contamination and Toxicology*, v. 64, no. 1, p. 32–51.
<https://link.springer.com/article/10.1007%2Fs00244-012-9813-0>
 10. Kemble, N.E., Hardesty, D.K., Ingersoll, C.G., Kunz, J.L., Sibley, P.K., Calhoun, D.L., Gilliom, R.J., Kuivila, K.M., Nowell, L.H., Moran, P.W., 2013, Contaminants in stream sediments from seven U.S. metropolitan areas: II. Sediment toxicity to the amphipod *Hyaella azteca* and the midge *Chironomus dilutus*: *Archives of Environmental Contamination and Toxicology* v. 64, no. 1, p. 52–64. <https://link.springer.com/article/10.1007%2Fs00244-012-9815-y>
 11. Nowell, L.H., Ludtke, A.S., Mueller, D.K., Scott, J.C., 2013, Organic contaminants, trace and major elements, and nutrients in water and sediment sampled in response to the Deepwater Horizon Oil Spill: U.S. Geological Survey Scientific Investigations Report 2012-5228.
<http://pubs.er.usgs.gov/publication/sir20125228>
 12. Nowell, L.H., Gilliom, R.J., Kemble, N.E., Ingersoll, C.G., Kuivila, K.M., Hladik, M.M., Moran, P.W., Calhoun, D.L., 2012, Case study: Contamination and toxicity of stream sediments increase with urban development. In Coles, J.F., McMahon, G., Bell, A.H., Brown, L.R., Fitzpatrick, F.A., Scudder Eikenberry, B.C., Woodside, M.D., Cuffney, T.F., Bryant, W.L., Cappiella, K., Fraley-McNeal, L., Stack, W.P. Effects of urban development on stream ecosystems in nine metropolitan study areas across the United States. United States Geological Survey Circular 1373.
 13. Norman, J.E., Nowell, L.H., Kuivila, K.M., Hladik, M.L., and Wydoski, D.S., 2013, Supplemental information B1. Prioritization of pesticides in water (Group B1), in Olsen, L.D., Valder, J.F., Carter, J.M., and Zogorski, J.S., Prioritization of constituents for national- and regional-scale ambient monitoring of water and sediment in the United States: U.S. Geological Survey Scientific Investigations Report 2012–5218,
<http://pubs.usgs.gov/sir/2012/5218/downloads/supplementalinformationB1>.
 14. Norman, J.E., Nowell, L.H., Kuivila, K.M., Van Metre, P.C., Pankow, J.F., and Wydoski, D.S., 2013, Supplemental information B2. Prioritization of pesticides in sediment (Group B2), in Olsen, L.D., Valder, J.F., Carter, J.M., and Zogorski, J.S., Prioritization of constituents for national- and regional-scale ambient monitoring of water and sediment in the United States: U.S. Geological Survey Scientific Investigations Report 2012–5218,
<http://pubs.usgs.gov/sir/2012/5218/downloads/supplementalinformationB2>.
 15. Nowell, L.H., Pankow, J.F., Van Metre, P.C., Wydoski, D.S., Hladik, M.L., 2013, Supplemental information F: Prioritization of lipophilic organic compounds in sediment (Group F). In Olsen, L.D., Valder, J.F., Carter, J.M., Zogorski, J.S., Prioritization of constituents for national- and regional-scale ambient monitoring of water and sediment in the United States: U.S. Geological Survey Scientific Investigations Report 2012-5218.
<http://pubs.usgs.gov/sir/2012/5218/downloads/supplementalinformationF>.
 16. Kuivila, K.M., Hladik, M.L., Ingersoll, C.G., Kemble, N.E., Moran, P.W., Calhoun, D.L., Nowell, L.H., Gilliom, R.J., 2012, Occurrence and potential sources of pyrethroid insecticides

- in stream sediments from seven U.S. metropolitan areas: *Environmental Science and Technology*, v. 46, no. 8, pp 4297–4303. <http://pubs.acs.org/doi/abs/10.1021/es2044882>
17. Norman, J.E., Kuivila, K.M., Nowell, L.H., 2012, Prioritizing pesticide compounds for analytical methods development: U.S. Geological Survey Scientific Investigations Report 2012-5045, 206 p. <http://pubs.er.usgs.gov/publication/sir20125045>
 18. Moran, P.W., Kuivila, K.M., Hladik, M.L., Ingersoll, C.G., Kemble, N.E., Moran, P.W., Calhoun, D.L., Nowell, L.H., Gilliom, R.J., 2012, Contaminants in stream sediments from seven U.S. metropolitan areas: Data summary of a national pilot study: U.S. Geological Survey Scientific Investigations Report 2011-5092, 66 p. plus appendices. <http://pubs.er.usgs.gov/publication/sir20115092>
 19. Phillips, P.J., Nowell, L.H., Gilliom, R.J., Nakagaki, N., Murray, K.R., VanAlstyne, C., 2010, Composition, distribution, and potential toxicity of organochlorine mixtures in bed sediments of streams. *Science of the Total Environment*, v. 408, no. 3, pp. 594-606. <https://doi.org/10.1016/j.scitotenv.2009.09.052>
 20. Nowell, L.H., Crawford, C.G., Gilliom, R.J., Nakagaki, N., Stone, W.W., Thelin, G.P., Wolock, D.W., 2009, Regression models for explaining and predicting concentrations of organochlorine pesticides in fish from United States streams. *Environmental Toxicology and Chemistry*, v. 28, no. 6, pp. 1346-1358. <https://doi.org/10.1897/08-508.1>
 21. Wilson, J.T., Baker, N.T., Moran, M.J., Crawford, C.G., Nowell, L.H., Toccalino, P.L., Wilber, W.G., 2008, Methods and sources of data used to develop selected water-quality indicators for streams and ground water for the 2007 edition of The State of the Nation's Ecosystems report with comparisons to the 2002 edition: U.S. Geological Survey Open-File Report 2008-1110, 62 p. <https://pubs.usgs.gov/of/2008/1110/>
 22. Sprague, L.A., Nowell, L.H., 2008, Comparison of pesticide concentrations in streams at low flow in six metropolitan areas of the United States. *Environmental Toxicology and Chemistry*, v. 27, no. 2, pp. 288–298. <https://doi.org/10.1897/07-276R.1>
 23. Sprague, L.A., Harned, D.A., Hall, D.W., Nowell, L.H., Bauch, N.J., Richards, K.D., 2007, Response of stream chemistry during base flow to gradients of urbanization in selected locations across the conterminous United States. U.S. Geological Survey Scientific Investigations Report 2007-5083, 133 p. <https://pubs.er.usgs.gov/publication/sir20075083>
 24. Nowell, L.H., Crawford, C.G., Nakagaki, N., Thelin, G.P., Wolock, D.M., 2006, Regression model for explaining and predicting concentrations of dieldrin in whole fish from United States streams. U.S. Geological Survey Scientific Investigations Report 2006-5020. At URL: <http://pubs.usgs.gov/sir/2006/5020/>
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ABSTRACTS AND PROCEEDINGS

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2. *Nowell, L.H., Mahler, B.J., Van Metre, P.C., Norman, Julia E., Moran, P.W., 2017, Evaluating potential acute and chronic effects of pesticide mixtures in streams from the Midwest, Southeast, and Pacific Northwest regions (USA). Society of Environmental Toxicology and Chemistry North America 38th Annual Meeting, Minneapolis, MN, Nov 12-16, 2017. Invited talk.
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4. *Nowell, L.H., Van Metre, P.C., Norman, J.E., Alvarez, D.A., Moran, P.W., Gellis, A., Waite, I.R., Schmidt, T.S., Rogers, H.A., Mahler, B.J., Stone, W.W., Shoda, M.E., Sandstrom, M.W., Hladik, M.L., 2016. Potential Effects of Pesticide Mixtures on Stream Quality in the Midwestern United States. Society of Environmental Toxicology and Chemistry North America 37th Annual Meeting and 7th SETAC World Congress, Orlando, FL, Nov 6-10, 2016. Invited talk.
5. Moran, P.W., Kemble, N.E., *Nowell, L.H., Hughes, J.P., Ingersoll, C.G., Waite, I., Van Metre, P., 2016. Characterization of sediment chemistry, sediment toxicity and macroinvertebrate communities in wadable streams of the Southeastern United States. Society of Environmental Toxicology and Chemistry North America 37th Annual Meeting and 7th SETAC World Congress, Orlando, FL, Nov 6-10, 2016.
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- Toxicity of Pesticide Mixtures in Water and Sediment in Midwestern U.S. Streams. 10th National Monitoring Conference, Tampa, FL, May 2-6, 2016.
8. Norman, J.E., Corbin, M., Nowell, L.H., Qian, Y., 2016, Occurrence and Characterization of Pesticide Mixtures in Midwest Streams and Rivers, and Implications for Sampling Strategies. 10th National Monitoring Conference, Tampa, FL, May 2-6, 2016.
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 13. *Nowell, L.H., Norman, J.E., Ingersoll, C.G., Moran, P.W., 2015. Development and application of freshwater sediment-toxicity benchmarks for currently used pesticides, invited talk, American Chemical Society 250th Annual Meeting, Boston, MA, August 16-20, 2015.
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- fatmucket *Lampsilis siliquoidea*, Society for Environmental Toxicology and Chemistry North America 35th Annual Meeting, Vancouver, B.C., Canada, November 9-13, 2014.
18. *Nowell, L.H., Norman, J.E., Moran, P.W., Martin, J.M., and Stone, W.W., 2014, Pesticide Toxicity Index for freshwater aquatic organisms: A screening-level tool for assessing Complex mixtures of pesticides in streams, 248th American Chemical Society National Meeting/13th IUPAC International Congress of Pesticide Chemistry, San Francisco, CA, August 10-14, 2014, abstract no. 907.
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 20. Nowell, L.H., Norman, J.E., Moran, P.W., Martin, J.M., and Stone, W.W., 2014, Pesticide Toxicity Index for freshwater aquatic organisms —A tool for assessing complex mixtures of pesticides in streams, 9th National Monitoring Conference, Cincinnati, OH, April 28-May 2, 2014, Session J5.
 21. *Nowell, L.H., Norman, J.E., Moran, P.W., Martin, J.M., and Stone, W.W., 2013, Pesticide Toxicity Index for freshwater aquatic organisms —A tool for assessing complex mixtures of pesticides in streams, Society for Environmental Toxicology and Chemistry North America 34th Annual Meeting, Nashville, TN, November 17-21, 2013, abstract no. 549.
 22. VanMetre, P.C., Frey, J.F., Nowell, L.H., Moran, P.W., Mahler, B.J., and Carlisle, D., 2013, USGS-USEPA Midwest Stream Quality Assessment: A regional-scale study to assess multi-stressor effects on stream ecology, Society for Environmental Toxicology and Chemistry North America 34th Annual Meeting, Nashville, TN, November 17-21, 2013, abstract no. 631.
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 24. *Nowell, L., Ludtke, A., Mueller, D., Scott, J., 2012, Organic contaminants and trace elements in water and sediment sampled in response to the Deepwater Horizon oil spill. 2012 National Monitoring Conference, April 30-May 4, 2012, Portland, OR.
 25. *Nowell, L.H., Moran, P.W., Kemble, N.E., Ingersoll, C.G., Kuivila, K.M., 2010, Distribution and toxicity of pesticides and other contaminants in stream sediments in relation to urbanization. American Chemical Society National Meeting, March 21-25, 2010, San Francisco CA, abstract no. 209.
 26. Kemble, N., Ingersoll, C., Moran, P., Nowell, L., Sibley, P., 2009, Evaluating the contribution of pyrethroids to the toxicity of urban stream sediments to amphipods and midges. Society for Environmental Toxicology and Chemistry 30th Anniversary Annual Meeting, November 19-23, 2009, New Orleans, LA, abstract no. MP129.
 27. Moran, P.W., Nowell, L.H., Calhoun, D.L., Kuivila, K.M., Gilliom, R.G., Kemble, N.E., Ingersoll, C.G., 2008, Sediment-associated contaminants in urban streams: I. Characterization and distribution of synthetic organics and trace elements in relation to urbanization. Society for Environmental Toxicology and Chemistry 29th Annual Meeting, Tampa, FL, November 16-20, 2008, abstract no. TP179.

28. Kuivila, K.M., Hladik, M.L., Gilliom, R.G., Nowell, L.H., Calhoun, D.L., Moran, P.W., Kemble, N.E., Ingersoll, C.G., 2008, Sediment-associated contaminants in urban streams: II. Distribution and sources of pyrethroid insecticides. Society for Environmental Toxicology and Chemistry 29th Annual Meeting, November 16-20, 2008, Tampa, FL, abstract no. TP181.
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30. *Nowell, L.H., Crawford, C.G., Nakagaki, N., Thelin, G.P., Wolock, D.M., 2006, Regression models for explaining and predicting concentrations of organochlorine pesticides in whole fish from U.S. streams: National Water Quality Monitoring Council, Fifth National Monitoring Conference, May 7–11 2006, San Jose, CA, abstract no. 073.
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32. *Nowell, L.H., Stephens, V.C., 2005, Contaminant mixtures in bed sediment from U.S. streams, and their potential toxicity to aquatic life: Society of Toxicology, Contemporary Concepts in Toxicology Workshop on Charting the Future: Building the Scientific Foundation for Mixtures Joint Toxicity and Risk Assessment, 16–17 February 2005, Atlanta, GA.
33. *Nowell, L.H., Stephens, V.C., 2004, Contaminant mixtures in bed sediment from U.S. streams, and their potential toxicity to aquatic life: Society of Environmental Toxicology and Chemistry Abstracts Book, Fourth World Congress and 25th Annual Meeting in North America, November 14–18, 2004, Portland, OR, abstract no. PH246, p. 468-469.
34. Toccalino, P., Norman, J., Kauffman, L., Nowell, L., Stackelberg, P., 2004, Assessing the occurrence of pesticides and VOCs in ground water in a human-health context. Proceedings of the 13th Annual Meeting of the Pacific Northwest Chapter of the Society of Environmental Toxicology and Chemistry, April 15-17, 2004, Port Townsend, WA.
35. Toccalino, P., Stackelberg, P., Kauffman, L., Nowell, L., Krietzman, S., Post, G., 2003, Application of health-based screening levels to ground-water quality data in a state-scale pilot effort. U.S. Geological Survey Open-File Report 03-097. Natural science and public health—Prescription for a better environment. Abstracts from the conference, April 1-3, 2003, Reston, VA.
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39. *Nowell, L.H., 1998, Development of water-quality standards and guidelines for pesticides and their use in water-quality assessments: Society of Environmental Toxicology and Chemistry Abstracts Book, South-Central/Ozark Prairie Regional Meeting, 20-22 April 1998, Wichita, Kansas.
40. Wong, C.S., Capel, P.D., Nowell, L.H., 1998, National-scale field-based evaluation of the applicability of biota sediment accumulation factors (BSAF): Society of Environmental Toxicology and Chemistry, Eighteenth Annual Meeting, 16-20 November 1997, San Francisco, CA, abstract no. 147, p 29-30.
41. Wong, C.S., Capel, P.D., Nowell, L.H., 1998, National occurrence and distribution of chlorinated organic compounds in stream bed sediments and biota : Society of Environmental Toxicology and Chemistry Abstracts Book, Eighteenth Annual Meeting, 16-20 November 1997, San Francisco, CA, abstract no. PMP026, p.127.
42. *Nowell, L.H., Dileanis, P.D., Capel, P.D., 1995, Pesticides in sediments and aquatic biota of United States rivers: Occurrence, geographic distribution, and trends: Society of Environmental Toxicology and Chemistry Abstracts Book, Second SETAC World Congress, 5-9 November 1995, Vancouver, B.C., abstract no. PT267, p. 218.
43. *Nowell, L.H., Hoffmann, B.L., Harrass, M.C. 1990. Food packaging and planning for solid waste management. First U.S. Conference on Municipal Solid Waste Management, June 14–16, 1990, Washington, DC.
44. *Nowell, L.H., Hoigné, J. 1987. Interaction of iron (II) and other transition metals with aqueous ozone. Proceedings of the International Ozone Association, 8th World Congress on Ozone, Zurich, Switzerland, September 1987, abstract no. E80.
45. Hoigné, J., Bader, H., Nowell, L.H. 1987. Rate constants for scavenging by humic substances: Role in ozonation and in a few photochemical processes for the elimination of micropollutants. Abstracts of the American Chemical Society, v. 193, p. 78-ENVR.

*Denotes presenter

Steven G. Saiz

PO Box 237, Atascadero, CA 93423
(805) 835-1472 cell
bluebee9@hotmail.com

Work Telephone: (805) 549-3879
Work email: ssaiz@waterboards.ca.gov

Education:

University of California, Davis, *Bachelor of Science* degree in *Wildlife and Fisheries Biology*, March 1985.

Experience:

Environmental Scientist

*California Environmental Protection Agency
Central Coast Regional Water Quality Control Board
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401*

May 2008 to Present

Responsible for basin planning by ensuring that beneficial uses, water quality standards, and implementation language in the Water Quality Control Plan for the Central Coastal Basin (Basin Plan) are appropriate. Bring Basin Plan amendments to Regional and State Water Board for approval. Conduct the Triennial Reviews of the Basin Plan. Prepare Basin Plan amendment administrative records for Office of Administrative Law approval. Member of statewide Basin Planning Roundtable. Currently developing a TMDL for biostimulatory substances in the Eklhorn Slough Estuary. Assist with water quality monitoring and the Central Coast Ambient Monitoring Program (CCAMP). Assist other programs as needed in the statistical analyses of environmental data. Review and approve Sustainability in Practice (SIP) certifications for vineyards.

Environmental Scientist

*California Environmental Protection Agency
State Water Resources Control Board (SWRCB)
Division of Water Quality, Ocean Unit
1001 I St., Sacramento, California*

Sept. 1993 to April 2008

Provided assistance to water quality and environmental issues of statewide concern including the California Ocean Plan, California Toxics Rule-State Implementation Policy (SIP), CA Thermal Plan, Impaired Waters Listing Policy, Once-through Cooling Policy. Provide detailed assistance to State and Regional Water Board staff and others in toxicity testing, dioxin regulation, NPDES permitting, Basin Plan amendments, power plant waste discharges, statistical analyses methods for non-detect data, dilution modeling, TMDL development, and desalination issues. Promulgated numeric water quality standards, compliance measures, and reasonable potential procedures in the CA Ocean Plan. Developed statistical decision rules and exceedance tables for listing and delisting impaired water bodies in the 2004 Policy for Developing California's Clean Water Act Section 303 (d) List. Review grant proposals for the CA Ocean Protection Council and the Resources Agency Sea Grant Advisory Panel (RASGAP). Skilled in statistical analysis of environmental data and computer programming. Author of BinomBal, Rpcalc, and LimCalc software used by Water Board staff and contracted permit writers.

SWRCB Accomplishment Award, April 2001.

SWRCB Sustained Superior Accomplishment Award, May 2006.

Steven G. Saiz

Page 2

Environmental Research Scientist

*California Environmental Protection Agency
Department of Pesticide Regulation
Div. of Pest Manag., Worker Health & Safety Branch
Sacramento, CA.*

Feb. 1986-Sept. 1993

Designed, coordinated, and conducted technical studies to determine environmental hazards of pesticide use. Sampled soil, water, air, foliage, and fruit for pesticide residues and wrote scientific reports of findings. Researched innovative application techniques designed to decrease amounts of pesticides used. Assisted in pesticide risk assessments and amendments of Food & Ag Code. Developed statistical techniques and computer simulations for toxicologists to estimate pesticide residue movement and dermal pesticide absorption in laboratory animals.

Pollution Laboratory Student Assistant

*California Department of Fish and Game
Water Pollution Control Laboratory,
Rancho Cordova, CA.*

Dec. 1982-Feb. 1984

Monitored water samples from fish hatcheries, local water supplies, and state research projects. Analyzed samples for chemical ions and physical properties using standard methods. Operated analytical balances, UV spectrophotometer, distillation apparatus, and chlorine test kits. Operated pH, dissolved oxygen, and turbidity meters. Assisted with mussel bioassays.

Deer Researcher

*Wildlife, Fish, & Conservation Biology Department
University of California, Davis, CA.*

June-Sept. 1984

CDFG contract project. Established field stations and monitored movements of radio transmitter-collared mule deer to determine summer range patterns in the Sierra National Forest.

Biologist Intern

*US Forest Service,
Klamath National Forest
Happy Camp Ranger District*

July 1983-Oct. 1983

Conducted habitat suitability surveys, recorded nesting chronology, and assisted with nesting habitat improvement project for forest raptors. Assisted botanists with sensitive forest plant species location and documentation in timber sale areas.

Publications:

Author of peer-reviewed publications in the following scientific journals:

Journal of the American Water Works Association, Toxicology and Applied Pharmacology, Transactions of the American Society of Agricultural Engineers, Acta Horticultura, Chemical Research in Toxicology, Journal of Agriculture and Food Chemistry, Bulletin of Environmental Contamination and Toxicology.

Neil Holland Willits

Born March 10, 1952
Palo Alto, California

Departmental Address:
Statistical Laboratory
Department of Statistics
University of California
Davis, CA 95616
(530) 554-9435
eMail: nhwillits@ucdavis.edu

Home Address:
3443 Oyster Bay Avenue
Davis, CA 95616
(530) 753-1198

Educational Background:

Palo Alto High School, graduated 1969
Foothill College, 1969-71
University of California at Davis, 1971-73
 B.S., mathematics, 1973
Stanford University, 1973-79
 M.S., statistics, Winter, 1978-79
 Ph.D., statistics, Winter, 1980-81

Postgraduate Employment:

Stanford University, Department of Statistics
 Postgraduate Fellow, 1979-81
University of California at Davis, Division of Statistics
 Assistant Professor, 1981-86
University of California at Davis, Division of Statistics
 Senior Statistician, Statistical Laboratory, 1986 to date

Publications:

1. Ott, Wayne and **Willits, Neil**. Modeling the Dynamic Response of an Automobile for Air Pollution Exposure Studies. Proceedings of Environmetrics 1981, SIMS, EPA, pp.104-105. (1981)
2. **Willits, Neil** and Ott, Wayne. The Effect of Intersections on the CO Exposures of Motorists. Proceedings of Environmetrics 1981, SIMS, EPA, pp.204-205. (1981)
3. Kelly, A.B., Steffey, E.P., McNeal, D., and **Willits, N.** Immediate and Long Term Effects of Halothane Anesthesia on Equine Platelet Function. Journal of Veterinary Pharmacology and Therapeutics, v. **8**, pp.284-289. (1985)
4. Smith, M.M., Zontine, W.J., and **Willits, N.** A Correlative Study of the Clinical and Radiographic Signs of Periodontal Disease in Dogs. Journal of the American Veterinary Association, v. **186**, pp.1286-1290. (1985)
5. Kelly, A.B., Steffey, E.P., **Willits, N.**, and McNeal, D., Temporal Quantification and Qualitative Effects of Halothane Anesthesia on Equine Platelets. Veterinary Surgery, v. **14**, pp.74-75. (1985)
6. Holland, M., Kelly, A.B., Snyder, E.P., Steffey, E.P., **Willits, N.**, and McNeal, D. Antithrombin III Activity in Horses with Large Colon Torsion. American Journal of Veterinary Research. v. **47**, pp.897-900. (1986)

7. Gregory, C.R., and **Willits, N.H.** Electromyographic and Urethral Pressure Evaluations: Assessment of Urethral Function in Female and Ovariohysterectomized Female Cats. *American Journal of Veterinary Research*. v. **47**, pp.1472-1475. (1986)

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Technical Reports:

1. **Willits, Neil H.** An Approach to Superefficient Estimation. SIMS Technical Report No. 45, Department of Statistics, Stanford University, 68 pages.

2. Ott, Wayne and **Willits, Neil H.** CO Exposures of Occupants of Motor Vehicles: Modeling the Dynamic Response of the Vehicle. SIMS Technical Report No. 48, Department of Statistics, Stanford University, 51 pages.

3. **Willits, Neil H.** Compliance Testing for Statistical Air Quality Standards. SIMS Technical Report No. 64, Department of Statistics, Stanford University, 11 pages.

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Recent Invited Talks

November 17, 1987 ``Compliance Testing for Statistical Air Quality Standards", presented at Environmetrics 87, Washington DC

January 13, 1988 ``Power calculations for veterinary experiments", presented to Veterinary Medicine Anesthesiology faculty research seminar series, University of California, Davis, CA

March 25, 1988 ``The proper use and interpretation of p-values", presented to School of Medicine Family Practice faculty research seminar series, Sacramento, CA

April 10, 1988 ``How to use a statistical consultant", presented to Veterinary Medicine Anesthesiology faculty research seminar series, University of California, Davis, CA

August 18, 1988 ``The El Camino CO Exposure Study, an overview", presented to EPA Workshop on Commuter Exposure to Air Pollution, Raleigh, NC

September 15, 1988 ``Statistical Pitfalls in Ecological Studies", presented to 3rd Biennial Conference on research in California's National Parks, Davis, CA

December 9, 1988 ``Sample size determination", presented to School of Medicine Family Practice faculty research seminar series, Sacramento, CA

April 4, 1989 ``How to use a statistical consultant", presented at Physical Education department seminar series, University of California, Davis, CA

May 4, 1989 ``Repeated measures models: Myth and reality", presented to School of Medicine Psychiatry faculty research seminar series, Sacramento, CA

March 1, 1990 ``Testing for Compliance with Statistical Air Quality Standards", presented to Mathematics department seminar series, Claremont Graduate School, Claremont, CA

March 5, 1990 ``Mixing your own Models using SAS", presented to SAS Users' Group meeting, University of California, Davis, CA

April 17, 1990 ``The World's Most Common Experiment: repeated measures models", presented to Physical Education department seminar series, University of California, Davis, CA

August 27, 1990 ``Statistical Issues in the Revision of California Groundwater Monitoring Requirements", presented at University Extension Conference on Groundwater Monitoring, Sacramento, CA

October 16, 1990 ``Traversing the Statistical Jungle with your Research Intact", presented to the Pomology Department research seminar series, University of California, Davis, CA

February 4, 1991 ``Statistical Issues in the Revision of California Groundwater Monitoring Requirements", presented to Graduate Group seminar series, Division of Statistics, University of California, Davis, CA

September 12, 1991 ``Statistical design and analysis considerations in Ecological studies", presented to 4th Biennial Conference on research in California's National Parks, Davis, CA

October 28, 1991 ``Statistical oversight by journals: when to curb your dogmatism", presented to Nematology department seminar series, Davis, CA

November 20, 1991 ``Intersection Effects on CO Exposures Travelling Along an Arterial Highway'', presented at `Measuring, Understanding, and Predicting Exposures in the 21st Century' (EPA sponsored conference), Atlanta, GA

February 19, 1992 ``How to use a statistical consultant'', presented at seminar series for Veterinary Medicine, Department of Surgery, Davis, CA

April 7, 1992 ``The role of randomization in experimental design'', first of a series of statistical talks for Emergency Medicine residents' seminar series, Sacramento, CA

September 24, 1992 ``Statistical issues in the review of California's ground water monitoring regulations'', presented at monthly meeting of Sacramento Statistical Association, Sacramento, CA.

January 25, 1993 through February 8, 1993 ``A pragmatist's guide to statistics: repeated measures models'', seminar series presented for faculty and graduate students in various UCD departments, Davis, CA.

February 16, 1993 ``How to use a statistical consultant'', presented to Physical Education Department seminar series, Davis, CA.

May 3, 1993 ``An overly simplistic guide to statistics'', presented to Veterinary Medicine department of Radiological Sciences seminar series, Davis, CA.

November 2, 1993 ``A backward introduction to Logistic Regression'', presented at seminar series in Department of Surgery, Medical School, Sacramento, CA.

January 24, 1994 through February 7, 1994 ``A pragmatist's guide to statistics: repeated measures models'', previous seminar series repeated for faculty and graduate students in various UCD departments, Davis, CA.

January 23, 1995 through February 6, 1995 ``A pragmatist's guide to statistics: logistic regression'', presented for faculty and graduate students in various UCD departments, Davis, CA.

February 27, 1995 ``Nonparametric and Robust Methods'', presented at seminar series in Department of Radiology, Medical School, Sacramento, CA.

May 1, 1995 through May 15, 1995 ``A pragmatist's guide to statistics: repeated measures models'', previous seminar series repeated for faculty and graduate students in various UCD departments, Davis, CA.

October 16, 1996 ``Statistical Computing Resources'', part of Division of Statistics Seminar Series.

May 30, 1997 ``Data Analysis for multiple year experiments'', presented at Agricultural Extension Research Conference, Davis, CA.

March 2, 1998 through March 9, 1998 ``A pragmatist's guide to statistics: repeated measures models'', revised seminar series presented for faculty and graduate students in various UCD departments, Davis, CA.

May 25, 2006 ``The Village Idiot's Guide to SAS: Data step trivia'', presented for Statistics graduate students, Davis, CA

June 1, 2006, ``The Village Idiot's Guide to SAS: Macros, bootstrapping and ODS'', presented for Statistics graduate students, Davis, CA

January 27, 2009, ``Stump the Statistician: miscellaneous design, SAS questions'', presented to Vegetable

Crops conference, Davis, CA

Teaching Experience

Statistical Methods in Engineering and the Physical Sciences (Statistics 116, Stanford, Fall 1979-80 and Spring 1980-81. Text: Bowker and Lieberman, *Engineering Statistics*)

Statistical Computing (Statistics 228, Stanford, Spring 1979-80)

Elementary Statistics (Statistics 13, UC Davis, taught 3 times, various texts)

Basic Statistical Analysis Through Computers (Statistics 32, UC Davis, taught twice, Text: Matloff, *Probability Modeling and Computer Simulation*, pre-publication notes)

Introduction to Probability Modeling and Statistical Inference (Statistics 102, UC Davis, taught 3 times, various texts)

Introduction to Probability Theory (Statistics 131A, UC Davis, taught twice, Text: Ross, *A First Course in Probability*)

Introduction to Mathematical Statistics (Statistics 131BC, UC Davis, Text: Hogg and Craig, *Introduction to Mathematical Statistics*)

Nonparametric Inference (Statistics 134, UC Davis, taught 3 times, Text: Lehmann, *Nonparametrics: Statistical Methods Based on Ranks*)

Statistical Computing (Statistics 141, UC Davis, taught 6 times, Text: Kennedy and Gentle, *Statistical Computing*)

Brief Advanced Mathematical Statistics (Statistics 230, UC Davis, Text: Bickel and Doksum, *Mathematical Statistics: basic ideas and selected topics*)

Mathematical Statistics (Statistics 231ABC, UC Davis, Texts: Bickel and Doksum, Cox and Hinkley: *Theoretical Statistics*)

Methods in Statistical Consulting (Statistics 401, UC Davis, taught 3 times, no text)

Seminar in Experimental Design and Analysis for Ecological Experiments (Ecology 290, UC Davis, taught six times, most recently in Winter, 2013)

SAS programming for Statistical Analysis (Statistics 201, UC Davis, taught 4 times, Text: Delwiche and Slaughter: *The Little SAS Book, 5th edition*)

Meeting Materials for Item 10



Delta RMP Joint Technical Advisory and Steering Committee Meeting

October 29, 2018
9:30 am – 4:30 pm

Cal/EPA Building
First Floor Training Room (East/West)
1001 I Street
Sacramento, CA 95814

Join the meeting: <https://join.me/sfei-conf-cw2>

To dial in by phone: +1.415.594.5500

Conference ID: 238-626-034 #

DRAFT Agenda

1	Introductions and Review Agenda Introduce TAC and SC members, establish quorum, and explain goals of the meeting		9:30 Gita Kapahi
2	Welcome to new Delta RMP participants. In the past year, several new organizations/ agencies have joined the program as contributing members. The coordinating committee has suggested adding 3 seats to represent agencies engaged in flood control and habitat restoration. The main participant in this new category is the Department of Water Resources (DWR) with its annual \$200,000 contribution. Desired outcome: <ul style="list-style-type: none">• Approve addition of a new voting members and alternates to the Steering Committee representing flood control and habitat restoration.		9:35 Patrick Morris

3	Decision: Approve Steering Committee Meeting Summary from July 17, 2018 and confirm/set next meeting dates Desired outcomes: <ul style="list-style-type: none"> • Approve meeting summary • Confirm upcoming meeting dates • TAC: Dec 12, 2017, Regional San • SC: Jan 23, 2018, CV Regional Board 	Draft Summary of July 28, 2017 SC Meeting*	9:40 Gita Kapahi
4	Information: Technical Advisory Committee Update Desired outcomes: <ul style="list-style-type: none"> • Inform the SC on key outcomes of the September 21, 2018 TAC meeting 	Draft Summary of 9/21/2018 TAC Meeting*	9:45 Stephen McCord
5	Discussion: Long-Range Planning In the fall of 2016, the SC set a planning budget of \$250,000 for each of the three active areas of Delta RMP monitoring (pesticides, mercury, and nutrients). As we enter a new planning cycle for the upcoming fiscal year, it is appropriate to revisit this decision. Desired Outcomes: <ul style="list-style-type: none"> • Updates to the 2015 Monitoring Design 	Memo on Current Monitoring Funds and Priorities a	10:00 Matthew Heberger
	Break		10:45
	Long-Range Planning Discussion (continued())		11:00
	Lunch On your own		12:30

* Draft reports and meeting summaries distributed to Steering Committee and TAC members only.

	Decision: Revisions to the Delta RMP Charter (If necessary) Desired outcome: <ul style="list-style-type: none"> • SC approval vote on the charter amendments. • Note that SC members may propose additional modifications to the Charter at any time, to be discussed at a future SC meeting. 		2:00 – 2:30 Matthew Heberger
	Human Health Impacts of Contaminants Suggested by the Pesticides Subcommittee. Mercury monitoring is specifically designed around understanding the human health impacts of consumption of contaminated sportfish. While human health is also relevant to study of pesticides and CECs, these programs have been designed primarily to investigate impacts to ecosystems. Invited speaker followed by discussion?		1 hour Speaker?
	Break		2:45
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	•		
14	Plan Agenda Items for Next SC Meeting See “Parking Lot” of potential future agenda items below.		4:15 Gita Kapahi
	Adjourn		4:30